Memorandum

To: *Sean Sheldrake, U.S. EPA Region 10*

From: *Lance Peterson, RG and Jeanette Mullin*

Date: *October 26, 2012*

Subject: *Gasco – U.S. Moorings Area Substantial Product Evaluation*

This memorandum presents CDM Smith Inc.'s (CDM Smith) evaluation of the presence of substantial product in the U.S. Government Moorings site (U.S. Moorings) offshore area based on a review of sediment core logs provided by the U.S. Army of Engineers (USACE) and Anchor QEA, LLC (Anchor QEA) on behalf of NW Natural. The U.S. Moorings offshore area is located within the Gasco Sediments Site Area of Interest.

Background

The Gasco Sediments Site 2009 Administrative Settlement Agreement and Order on Consent for Removal Action (AOC) Statement of Work (SOW) identifies the process that is to be used to delineate the interim project area. The SOW specifies that the interim project area is to be identified in the Engineering Evaluation/Cost Analysis (EE/CA) and Data Report as outlined in Section 3.6.1. Section 3.6.2 of the SOW identifies the nine risk criteria that are to be used to delineate the interim project area. These nine risk criteria or lines of evidence include:

1. Substantial Presence of Product
2. Benthic Toxicity Bioassays
3. Benthic Toxicity Models
4. Human Health Shellfish Consumption
5. Human Health Direct Sediment Exposures
6. Sediment Probable Effects Concentrations (PECs)
7. Portland Harbor "Baseline" Polycyclic Aromatic Hydrocarbon (PAH) Levels
8. Groundwater Plume Concentrations (i.e., Transition Zone Water [TZW])
9. Other Potential LOEs (based on the Portland Harbor Baseline Risk Assessments)

In May 2012, NW Natural submitted a draft *Engineering Evaluation/Cost Estimate* (EE/CA)[1] for the Gasco Sediments Cleanup Site to the U.S. Environmental Protection Agency (EPA) for review. Consistent with the AOC, Removal Action Objectives (RAOs) presented in the EE/CA include a preference to remove "sediments containing substantial amounts of product that may serve as potential future source of risk material, unless it can be shown that the costs of such removal are clearly disproportionate to the degree of risk reduction to be attained through physical removal as compared to other remedial options for the same material." Section 2.5.3 of the EE/CA provides a summary of substantial product observations within the Gasco Sediments Site Area of Interest. Gasco EE/CA Figure 2.5.3-1, which is provided in **Attachment A** for reference, shows the core locations where NW Natural identified substantial product based on visual observations and using the definition of substantial product described in the Gasco Sediments Site 2009 AOC SOW. As shown on Figure 2.5.3-1, no substantial product was identified in the U.S. Moorings offshore area by NW Natural in the draft EE/CA.

The USACE was provided a copy of the draft EE/CA for review. The USACE submitted a letter dated August 14, 2012, to EPA in which USACE presented their own evaluation of substantial product in the U.S. Moorings offshore area using core data collected during the U.S. Moorings 2008 Remedial Investigation (RI) and 2008/2009 supplemental investigation. The USACE August 14, 2012 letter is provided in **Attachment B** for reference.

USACE identified 9 core locations that they believe meet the definition of substantial product as defined in the Gasco 2009 AOC SOW. These locations are shown on Figure 1 of their letter provided in **Attachment B**. These locations included SDDC-24, 20BF, 43BB, 50BG, 53BD, SDDA-18, SDDA-19, SDDB-20, and SDDC-23.

Anchor QEA reviewed the USACE August 14, 2012 letter on behalf of NW Natural and provided a response to EPA in a letter dated September 24, 2012. This response is provided in **Attachment C**. Anchor QEA concluded that none of the locations contained substantial product as defined in the SOW, except for possibly core location 50-BG, due to "incorrectly applied assumptions coupled with the likely bias in the logging terminology." Even for core location 50-BG, Anchor QEA indicated that this station should be designated as inconclusive because even though "NAPL"[non-aqueous phase liquid] is listed in the log, there are "no clarifying descriptors of seams or layers of liquid of such NAPL…"

Substantial Product Definition

RAOs presented in Section 3.2 of the AOC SOW requires "removal of sediments containing substantial amounts of product (e.g., solid "tar" and/or NAPL) that may serve as potential future source of risk material, unless it can be shown that the costs of such removal are clearly

[1] Anchor QEA, LLC. 2012. *Draft Engineering Evaluation/Cost Estimate, Gasco Sediments Cleanup Site.* Prepared for U.S. EPA Region 10 on behalf of NW Natural. May 2012.

disproportionate to the degree of risk reduction to be attained through physical removal as compared to other remedial options for the same material."

The working definition of substantial product is provided in Section 3.6.2.1 of the Gasco 2009 AOC SOW. Direct text taken from the SOW regarding the definition of substantial product is provided below for reference:

3.6.2.1 Substantial Presence of Product

Areas with substantial presence of product in sediments is a line of evidence related to potential mobility of chemicals in the future, and thus related to risks identified in the BLRA [Draft Baseline Risk Assessment]. Visual observations in sediment cores shall be the primary parameter used for this line of evidence. As noted above, the term "substantial" product is intended to 1) target product that is related to potential future mobility and 2) indicate a preference for removal as defined by RAO [Remedial Action Objective] #1. The definition of substantial product does not include every incidence of product observation at the site. Based on core observations, the working definition of "substantial presence of product" is those sediments that meet the following criteria:

1. *Bands of product, layers of product, "saturated" sediments, "stained" sediments, and/or seams of product that are greater than 2 inches thick.*
2. *Any layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., "oozes" or "drips" out of the core during core observations).*

Modifying factors to this definition are:

3. *If top 5 ft of core has no substantial product under Criteria #1, then deeper product should be judged as "not substantial", even if relatively thick layers of product exist at greater depths.*
4. *If there are any seams of mobile liquid NAPL (not solid or semisolid tar) per Criteria #2 then this is substantial product regardless of depth and the characteristics of overlying sediments.*

The following is NOT substantial product:

- *Any layers of non-mobile product (i.e., bands, layers, saturated sediments, stained sediments) that are less than 2 inches thick.*
- *Petroleum odors that are not associated with visual evidence of product beyond sheens and blebs.*
- *Sheens that are not associated with more substantial visuals of product.*
- *Isolated product blebs or spots not associated with more substantial visuals of product.*

Criteria #3 shall consider whether the 5 feet of overlying relatively clean material includes any sediment that would be expected to be removed as part of Army Corps maintenance dredging in the navigation channel. If so, the 5 ft depth requirement should be judged from the depth to which maintenance dredging would occur. The edges of the area with "substantial presence of product" shall be defined by cores which do not contain substantial product. Examples of product containing cores that meet the definition of "substantial product" and examples of cores that do not meet this definition are shown in Figure 3.

Re-Evaluation of Sediment Core Logs

Because the substantial product identification is critical to the evaluation of removal action alternatives in the draft EE/CA, CDM Smith undertook an evaluation of sediment core logs to determine whether substantial product was present consistent with the definition presented in Section 3.6.2.1 of the AOC SOW. It should be noted that this memo focuses on only one of the nine lines of evidence that are to be used to define the Gasco Sediments Site interim project area.

To assist with the evaluation of substantial product, Anchor QEA provided 14 core logs to CDM Smith and USACE provided one additional core log to supplement the 9 core logs provided with their letter for CDM Smith to review. CDM Smith reviewed a total of 24 core logs to evaluate the presence of substantial product in the U.S. Moorings offshore area. These 24 logs are provided in **Attachment D**. While Anchor QEA discounted USACE's logs due to what they considered bias and improper logging, CDM Smith found some of the logs submitted by Anchor QEA to be equally difficult to interpret based on the lack of information or details provided on the logs. As the actual cores were not available for review in the evaluation, judgments had to be made based on the information and descriptions as provided in the logs.

Based on a review of the logs, three core locations were identified as containing substantial product. Two other locations were identified as containing substantial product based on the depth to which future maintenance dredging outside the navigation channel is anticipated to occur. Details regarding the location, depth, thickness of product layers, description, and rational for the interval being defined as containing substantial product are provided on **Table 1**. The following core locations are identified as containing substantial product based on the depth from the current mudline:

- 50-BG Presence of NAPL at various depth intervals
- GS-01 2-foot thick layer of staining in conjunction with hydrocarbon-like odor within 5 feet of mudline
- SDDA-18 3-inch thick layer of stained sediment with strong odor and sheen within 5 feet of mudline

The following core locations are identified as containing substantial product based on the depth to which future maintenance dredging outside the navigation channel is anticipated to occur:

- 20-BF — 2.8-inch thick black layer with strong odor and sheen within 5 feet of mudline after future maintenance dredging outside the navigation channel
- C528 — Inconclusive. The log indicates black-stained bands up to 5.5 inches thick occur within the interval from 5.1 to 14.8 feet below the current mudline. Although the log does not specify the exact locations in this interval, some of these bands may be within 5 feet of the mudline after future maintenance dredging outside the navigation channel.

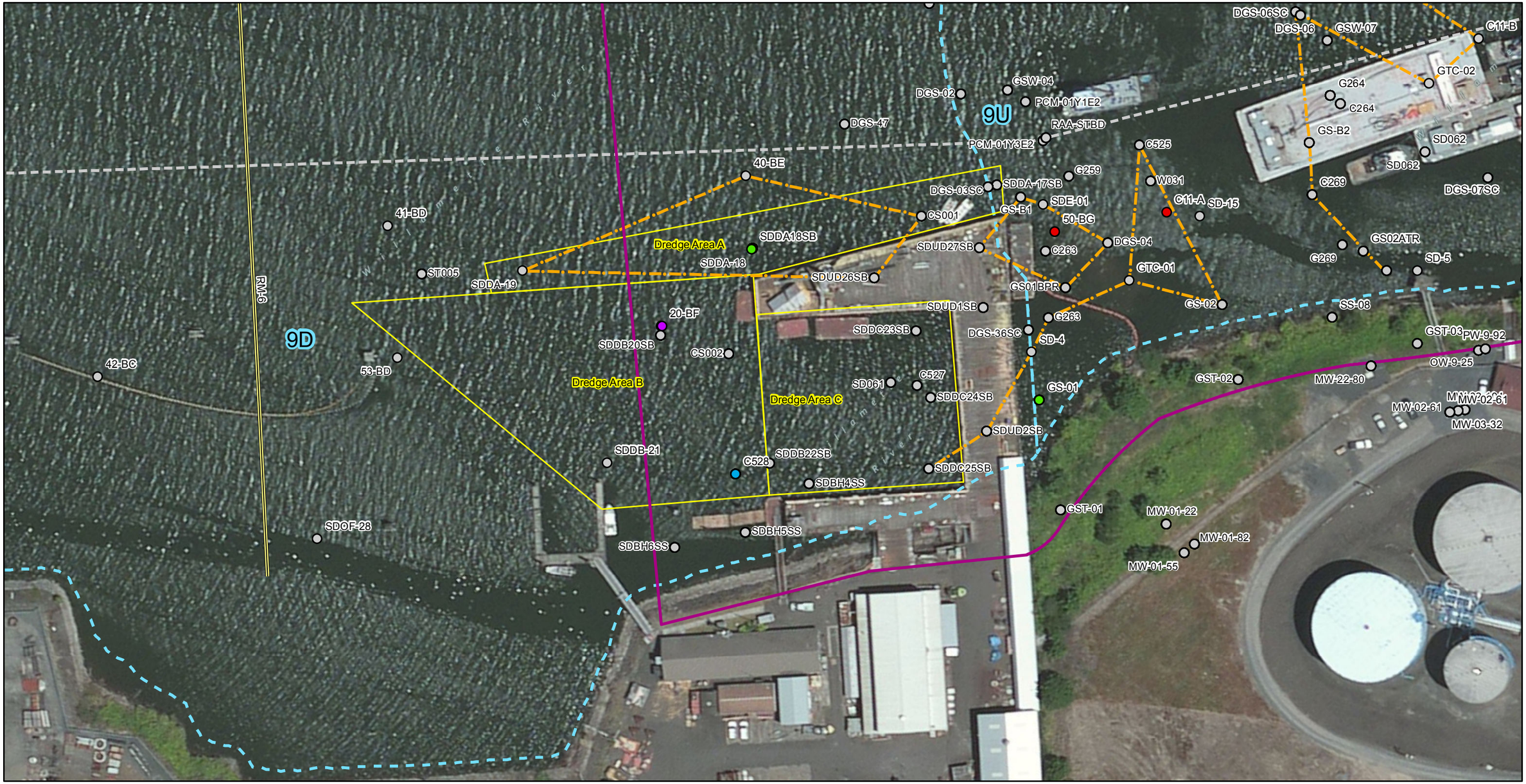
Copies of the logs where substantial product has been identified are provided in **Attachment E**. The interval where substantial product has been identified has been highlighted on each log for review.

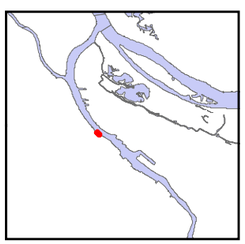
Figure 1 presents a summary of substantial product in the U.S. Moorings offshore area. The edges of the area with "substantial presence of product" are shown by the orange dashed line and are consistent with the SOW requirement that it "shall be defined by cores which do not contain substantial product." The "substantial presence of product" area shown on the figure does not take into account the locations where "substantial product" was delineated based on future maintenance dredging depths because the SOW indicates the 5 foot depth requirement should be judged from the depth to which maintenance dredging would occur "**in the navigation channel**." The three future maintenance dredging areas identified by USACE in their August 14, 2012 letter are outside the navigation channel and the EPA would need to determine if the 5 foot depth evaluation requirement should be applied to these areas. **Figure 1** identifies the core locations where substantial product has been identified within 5 feet of future dredge depths, but these cores were not used to define the "substantial presence of product" area.

Conclusion

Based on the substantial product line of evidence, CDM Smith's review has identified three additional areas of substantial product offshore of the U.S. Moorings facility as depicted on **Figure 1**.

This review only evaluated the substantial presence of product line of evidence. Although the substantial product line of evidence is considered critical based on RAO 1 which specifies a preference for removal of substantial product, consideration of the other lines of evidence presented above may further refine the project boundary.





CDM Smith

Legend

- Substanial Product Boundary
- Gasco Sediments Site Area of Interest
- U.S. Moorings Maintenance Dredge Areas
- AOPC Boundary
- Navigation Channel
- River Miles
- No Substantial Product
- Non-Aqueous Phase Liquid (NAPL)
- Substantial product from 0-5 feet below mudline
- Substantial product within 5 ft of new surface material
- Substantial product may be within 5 ft of new surface material (unclear from log)

Figure 1
Summary of Presence of Substantial Product
U.S. Moorings Offshore Area
Gasco Sediments Site Area of Interest

100 50 0 100 Feet

Date: 10/17/2012

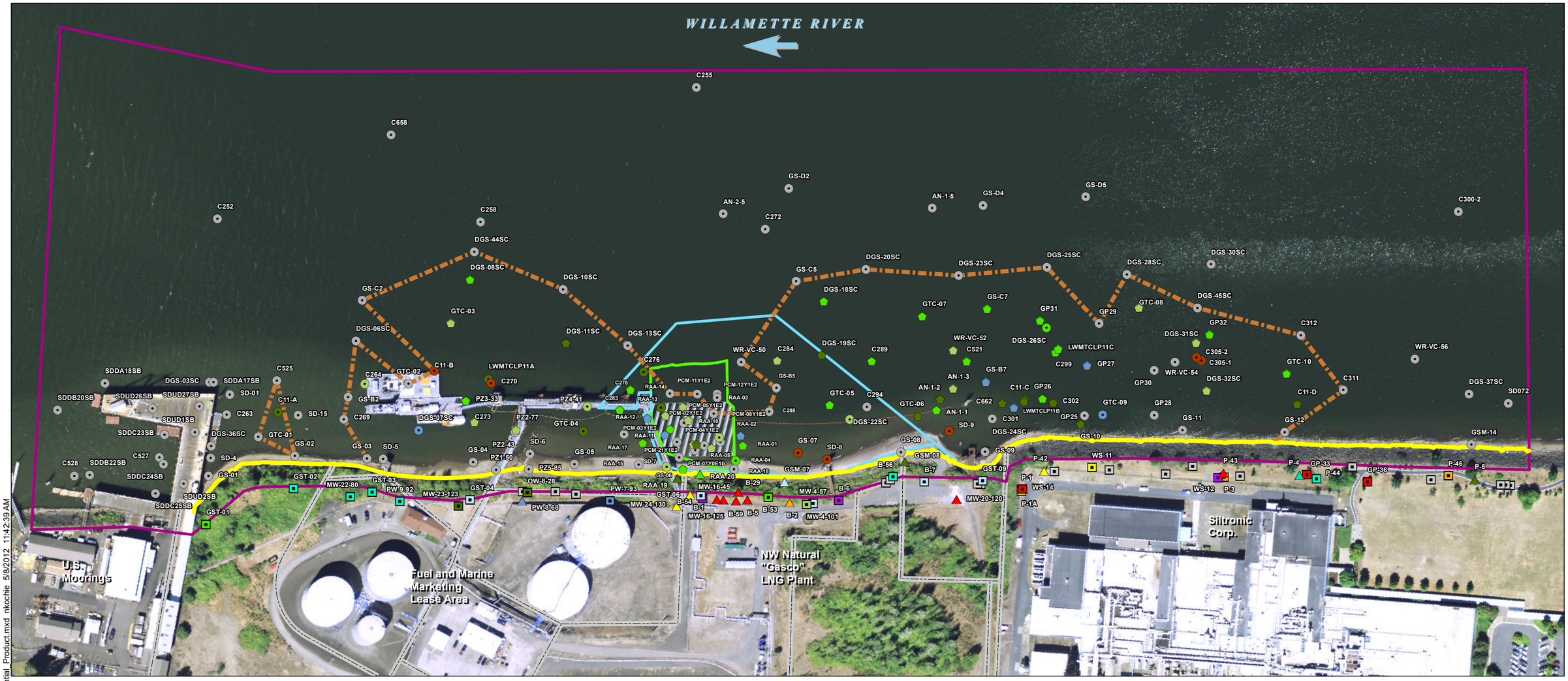
Table 1
Borings Containing Evidence of "Substantial Product"
U.S. Moorings Site
Portland Harbor Superfund Site

Boring No.	Top Depth (in)	Bottom Depth (in)	Unit Thickness (in)	Depth Below Mudline (ft)	Depth Below Mudline After Anticipated Dredging[1] (ft)	Description	Justification for "Substantial Product" Designation
20 BF	113.4	116.1	2.8	9.4	4.7	Black laminar band: strong coal tar odor and blue ropy sheen produced with application of water.	Will be within 5 feet of maintenance dredging new surface.
50 BG	55.1	56.0	0.9	4.6	NA	Black stained sediment band in laminar orientation. NAPL.	Presence of liquid NAPL.
	100.8	102.8	2.0	8.4	NA	In-situ sheen, mineralized NAPL bands, very strong naphthalene odor. NAPL.	Presence of liquid NAPL.
	124.0	124.8	0.8	10.3	NA	Black, strong in situ sheen and NAPL. Very strong coal tar and naphthalene odor.	Presence of liquid NAPL.
	137.8	138.6	0.8	11.5	NA	Black, in-situ sheen, NAPL, very strong coal tar odor.	Presence of liquid NAPL.
C528	60.6	177.2	5.5	5.1	0.0	Black stain in bands up to 14 cm [5.5 in] thick starting at 154 cm [60.6 in], sheen on some bands. (Log does not indicate where the staining ends so it is assumed through the length of this interval.)	May be within 5 feet of maintenance dredging new surface.
GS-01	0.0	24.0	24.0	0.0	NA	Black staining 0 to 2.0 feet. Hydrocarbon-like odor.	Located within 5 feet of surface and over 2 inches in thickness.
SDDA-18	53.0	56.0	3.0	4.4	To be removed by dredging	Bands of black sediment that has strong PAH odor and sheen.	Located within 5 feet of surface and over 2 inches in thickness.

Notes:
1) Dredging depths based on future dredge areas as delineated by the U.S. Army Corps of Engineers in their August 14, 2012 letter to U.S. Environmental Protection Agency providing their evaluation of substantial product at the U.S. Moorings site.
ft - feet
NAPL - Non-aqueous phase liquid
NA - Not applicable; no maintenance dredging anticipated to occur in this area
Substantial Product that will be within 5 feet of new surface material after future anticipated dredging

Attachment A

Gasco EE/CA Figure 2.5.3-1



- Sediment Coring Location
- Core with Liquid Substantial Product
- Shoreline Soil Boring Location
- Boring with Potential Mobile Product
- Inconclusive Substantial Product
- No Substantial Product
- Substantial Product from 0-4 feet Below Mudline
- Substantial Product from 4-8 feet Below Mudline
- Substantial Product from 8-12 feet Below Mudline
- Substantial Product from 12-16 feet Below Mudline
- Substantial Product from 16-20 feet Below Mudline
- Substantial Product from 20-24 feet Below Mudline
- Substantial Product from 24-28 feet Below Mudline
- Substantial Product from 28-32 feet Below Mudline
- Substantial Product from 32-36 feet Below Mudline
- Substantial Product >36 feet Below Mudline

- Gasco Sediment Site Area of Interest (Final Work Plan [Anchor QEA 2009])
- Substantial Product Area
- Tar Body Removal Action 6-inch Fringe Cover Placement
- Tar Body Removal Action Area (RAPP [Anchor 2005])
- Tar Body Removal Action Pilot Cap
- Boundary of EPA Managed Sediments and DEQ Managed Uplands – 13 feet NAVD88

NOTES:
1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 HARN Oregon State Plane North, Intl. Feet.
3. Vertical datum is NAVD88.
4. Aerial imagery from July 2007.
5. Review of the core logs at the locations designated as Inconclusive Substantial Product provided insufficient information to confirm the presence of substantial product using the definition in the Statement of Work (e.g., stained sediments noted in an interval but no thickness provided).
6. The designated depths of substantial product are the deepest depth of substantial product observed in the core/boring log. Shallower depths may not contain substantial product.
7. Locations designated as containing liquid substantial product contain liquid substantial product in at least one depth interval. These locations may also contain non-liquid substantial product and the shown deepest depth interval designation may be driven by either liquid substantial or non-liquid substantial product.
8. Per the SOW, the definition of substantial product does not apply landward of the top of the riverbank. The shown top of riverbank borings were screened against the SOW substantial product definition solely to support evaluation of substantial product in the riverbank.

Q:\Jobs\000029-02_Gasco\Maps\EECA\EECA_Substantial_Product.mxd nkochie 5/8/2012 11:42:39 AM

ANCHOR QEA

Feet
0 100 200 300 400

Figure 2.5.3-1
Summary of Presence of Substantial Product
Draft Engineering Evaluation/Cost Analysis
Gasco Sediments Cleanup Action

Attachment B

USACE U.S. Moorings Substantial Product Letter

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, PORTLAND DISTRICT
PO BOX 2946
PORTLAND OR 97208-2946

REPLY TO
ATTENTION OF

Planning Programs and Project
Management Division

AUG 1 4 2012

Sean Sheldrake, RPM
USEPA, Region 10
Environmental Cleanup Office
1200 Sixth Avenue, Suite 900, ECL-110
Seattle, WA 98101-3140

Dear Mr. Sheldrake:

Enclosed please find the U.S. Army Corps of Engineers' (USACE) summary of substantial product located at the U.S. Government Moorings (U.S. Moorings) site. Sediment core data collected during the Remedial Investigation and a supplemental investigation were evaluated in accordance with the substantial product criteria specified in the Gasco Sediment Site Statement of Work (SOW). As described in the enclosed technical memorandum, much of the substantial product at depth would be disturbed and/or exposed by maintenance dredging activities or prop wash. All locations that identified areas of substantial product were based on the most current data; however, further investigation may be necessary to define the extent of substantial product at the U.S. Moorings site.

The USACE would also like to point out a couple items identified during this detailed review of the sediment core data. First, location SDOF28 was previously identified as containing substantial product; however, after further evaluation, it was determined that this location did not meet the criteria specified in the SOW. Second, location 20BF was added to the list of cores that meet the criteria for substantial product.

If you have any questions, please contact me at 503-808-4725 or email at christine.m.budai@usace.army.mil. An electronic copy of this letter with enclosure has been provided to Lori Cora (cora.lori@epa.gov), Mark Ader (ader.mark@epa.gov), Jim Anderson (anderson.jim@deq.state.or.us), Dana Bayuk (bayuk.dana@deq.state.or.us), Bob Wyatt (rjw@nwnatural.com), and Patty Dost (pdost@pearllegalgroup.com).

Enclosure

Sincerely,

Christine M. Budai

Christine M. Budai, RPG, PMP
Project Manager

CENWS-EN-GB 27 July 2012

TECHNICAL MEMORANDUM FOR: Chris Budai, Project Manager U.S. Government Moorings

SUBJECT: Summary of Substantial Product in Sediment Cores, U.S. Government Moorings

The purpose of this memorandum is to provide documentation of substantial product found at depth at the U.S. Government Moorings (U.S. Moorings) site. The data provided herein were collected under two previous investigations: The U.S. Moorings Remedial Investigation (RI) in 2008 and a supplemental investigation in 2008/2009.

Definition of Substantial Product

The evaluation of substantial product was completed in accordance with the criteria provided in the Statement of Work (SOW) for the Gasco Sediment site (dated September 9, 2009). The criteria are as follows:

1. *Bands of product, layers of product, "saturated" sediments, "stained" sediments, and/or seams of product that are greater than 2 inches thick.*
2. *Any layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., "oozes" or "drips" out of the core during core observations).*

Modifying factors to this definition are:

3. *If top 5 ft of core has no substantial product under Criteria #1, then deeper product should be judged as "not substantial", even if relatively thick layers of product exist at greater depths.*
4. *If there are any seams of mobile liquid NAPL (not solid or semisolid tar) per Criteria #2 then this is substantial product regardless of depth and the characteristics of overlying sediments.*

The following is NOT substantial product:

- *Any layers of non-mobile product (i.e., bands, layers, saturated sediments, stained sediments) that are less than 2 inches thick.*
- *Petroleum odors that are not associated with visual evidence of product beyond sheens and blebs.*
- *Sheens that are not associated with more substantial visuals of product*
- *Isolated product blebs or spots not associated more substantial visuals of product*

Criteria 3 shall consider whether the 5 feet of overlying relatively clean material includes any sediment that would be expected to be removed as part of Army Corps maintenance dredging in the navigation channel. If so, the 5 ft depth requirement should be judged from the depth to which maintenance dredging would occur.

U.S. Moorings Data

Subsurface sediment core logs and photographs collected during the RI and supplemental investigation were reviewed to determine where the criteria for substantial product were met at the U.S. Moorings site. Lithology descriptions indicative of sediment discoloration (i.e. staining) with associated odors and/or sheen were interpreted as layers containing product. These layers were typically described as "black" or "banded." Only layers greater than 2-inches thick were identified as substantial product, per the SOW criteria. In cases where the "band" thickness was not stated on the core log, core photographs were used to determine which layers met the 2-inch criteria. Core log descriptions that used the term NAPL were interpreted as potential mobile NAPL zones and thus substantial product, regardless of the layer thickness. Note that although core 43BB did not specifically state sediment discoloration, review of the core photograph indicated a discolored zone associated with the location of odor and NAPL blebs described on the logs. Therefore, 43BB was identified as containing substantial product.

Enclosure

Figure 1 shows the core locations where substantial product was identified. Attachment 1 presents summary core logs highlighting the description that identified the location as containing substantial product. Attachment 2 presents the core photographs with the location of substantial product. For reference, the full core logs from the RI and supplemental investigation are included in Attachment 3.

Additional lines of evidence of sediment contamination are also present at the U.S. Moorings site, such as observations of product less than 2-inches thick and elevated contaminant concentrations in sediment. A detailed analysis of this data is beyond the scope of this memorandum; however, a summary table of chemical characteristics along with sediment core observations indicative of product is presented in Attachment 4 for reference.

U.S. Moorings Dredge Maintenance Requirements

The U.S. Moorings facility needs to accommodate two ocean-going hopper dredges, the Essayons and Yaquina, as part of the navigation mission for the U.S. Army Corps of Engineers. Existing shoaling has reduced the navigational depths substantially, and berth dredging and dock repairs have both been placed on hold because of sediment contamination.

Figure 1 shows future dredge areas (A, B, and C) that may be designed to expose a clean face or to include sufficient over-depth to accommodate a cap. For the purpose of the RI, the dredge depths were defined assuming a 5-foot cap thickness, including armor and barrier/filter. The depths of water in the berths will be -31 feet Columbia River Datum (CRD) for the Essayons and -19 feet CRD for the Yaquina. Assumed dredge depths are:

- Dredge Area A: total dredge depth of -36 feet CRD
- Dredge Area B: total dredge depth of -24 feet CRD
- Dredge Area C: total dredge depth of -24 feet CRD

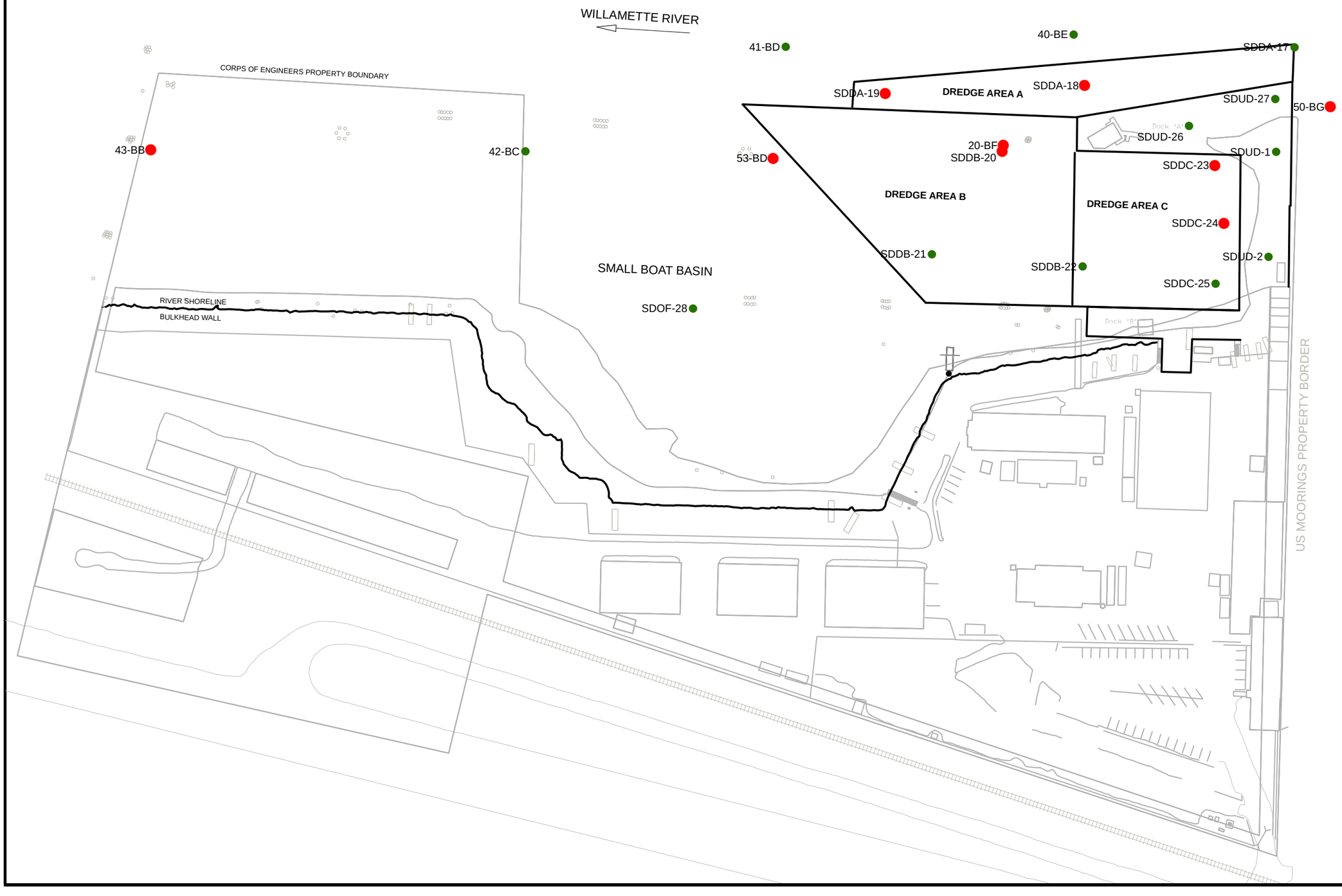
It should be also assumed that the dock area will need to be dredged to a total depth between -24 and -36 feet CRD to remove substantial product, which would require dock removal to prevent reduced structural integrity of the load bearing piles.

The summary core logs show the elevation of substantial product referenced to CRD. Six of the cores with substantial product fall within the designated dredge areas with the assumed dredge depth extending below zones identified as containing substantial product. In these areas, substantial product will be mobilized, if not removed, prior to maintenance dredging. Core 53BD is located just outside the assumed dredge area with substantial product identified below a depth of 5 feet. Since the location of this core has a high potential for scour due to prop wash, substantial product in this areas may also be mobilized.

Attachments:

Attachment 1 – Summary Core Logs
Attachment 2 – Core Photographs
Attachment 3 – Core Logs from the Remedial Investigation and Supplemental Investigation
Attachment 4 – Summary of Bulk Chemical Characteristics in Subsurface Sediment Cores

Enclosure



LEGEND

- Subsurface Sediment Location with Substantial Product
- Subsurface Sediment Sample Location

N

0 50 100 200 Feet

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT

FIGURE 1
SUBSURFACE SEDIMENT CORE LOCATIONS

U.S. GOVERNMENT MOORINGS

Enclosure

Attachment 1

Summary Core Logs

Summary Log Legend


SW - Well-graded sands or gravel-sand mixtures, little to no fines


SM - Silty sands, sand-silt mixture

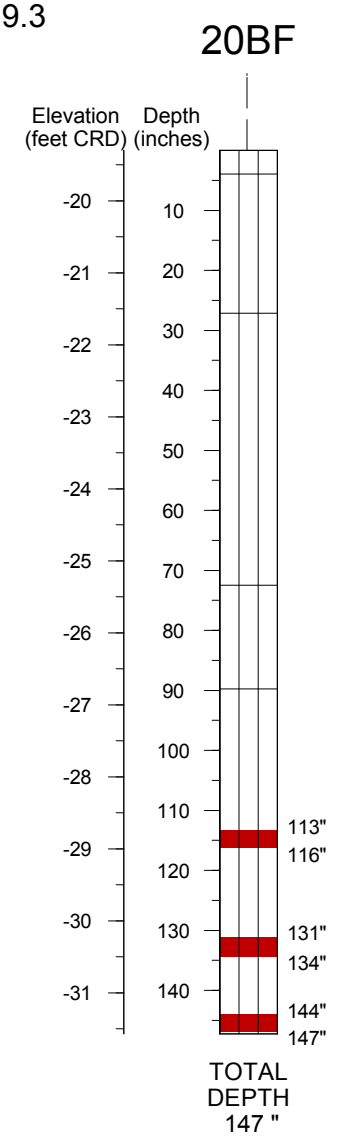

ML - Inorganic silts and very fine sands, silty or clayey find sands or clayey silts with slight plasticity


OL - Organic silts and organic silty clays of low plasticity


Pt - Peat or other highly organic soils

Interval identified as containing substantial product

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 8/25/2009
Mudline Elevation (feet CRD): -19.3
Latitude (deg): 45.58181633
Longitude (deg): 122.7625082



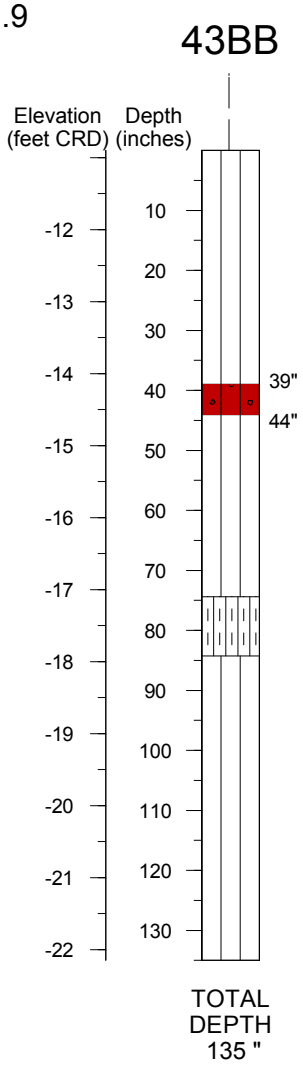
Black, laminar bands at:
(288-295 cm) strong coal tar odor and blue ropy sheen produced with application of water

(333-341 cm) interval is slightly sandy (<10%) and has slight vanillin odor in addition to strong coal tar odor

(366-373 cm) strong coal tar odor and blue ropy sheen produced with application of water

Enclosure

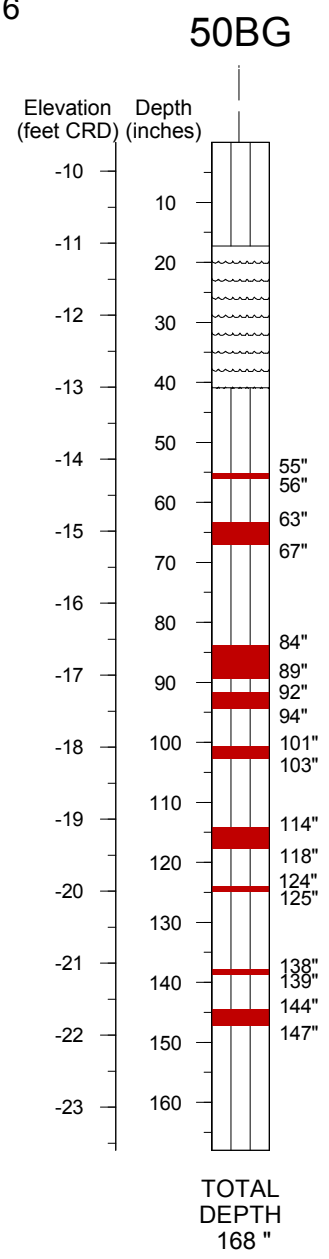
Project: US Moorings
Location: Portland,Oregon
Date Drilled: 8/25/2009
Mudline Elevation (feet CRD): -10.9
Latitude (deg): 45.58329783
Longitude (deg): 122.7651988



(99-112 cm) Stiff, damp to dry, in situ sheen at 110.5 cm, moderate coal tar odor and small (1-2mm) blebs of brown NAPL and ropy sheen can be floated out with application of water.
[Core photo used to determine staining present]

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 8/25/2009
Mudline Elevation (feet CRD): -9.6
Latitude (deg): 45.58133
Longitude (deg): 122.7613838



(140-142.2 cm) Black stained sediment band in laminar orientation. NAPL.
(161-170 cm) Black, woody, strong coal tar odor.

(213-227 cm) Very strong naphthalene odor. NAPL and blue sheen with application of water.
(233-240 cm) Very strong naphthalene odor. NAPL and blue sheen with application of water.

(256-261 cm) In-situ sheen, mineralized NAPL bands, very strong naphthalene odor. NAPL.

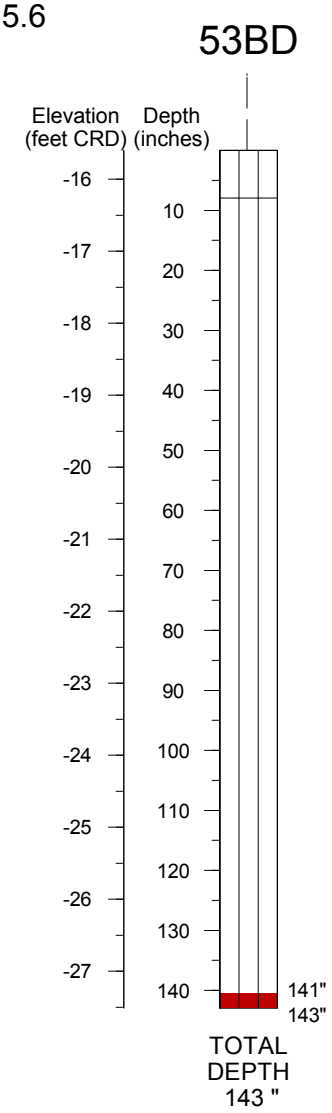
(290-299 cm) Black, dense in-situ sheen. Very strong coal tar odor.

(315-317 cm) Black, strong in-situ sheen and NAPL. Very strong coal tar and naphthalene odor.

(350-352 cm) Black in-situ sheen. NAPL, very strong coal tar odor.
(367-374 cm) Black, in-situ sheen. Strong coal tar odor.

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 8/25/2009
Mudline Elevation (feet CRD): -15.6
Latitude (deg): 45.582191
Longitude (deg): 122.763263

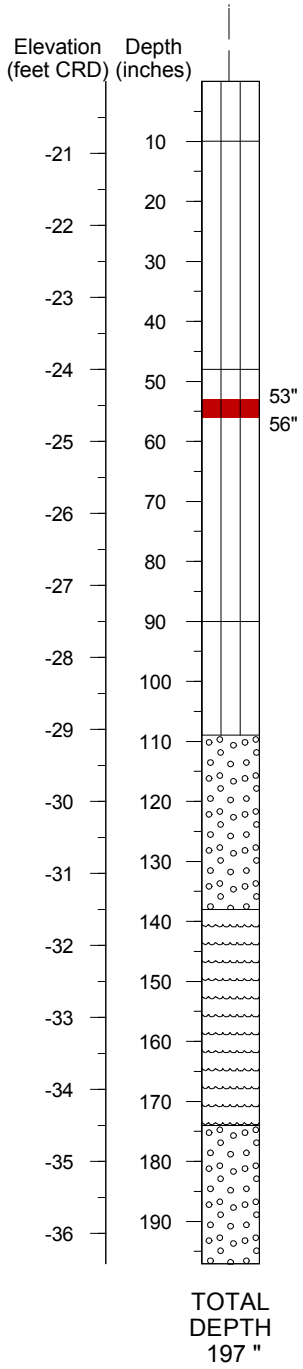


(357 -363 cm) Black stained band of sediment with strong coal tar odor and sheen can be produced in-situ with application of pressure.

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 4/20/2008
Mudline Elevation (feet CRD): -20
Latitude (deg): 45.58180583
Longitude (deg): 122.7621028

SDDA-18

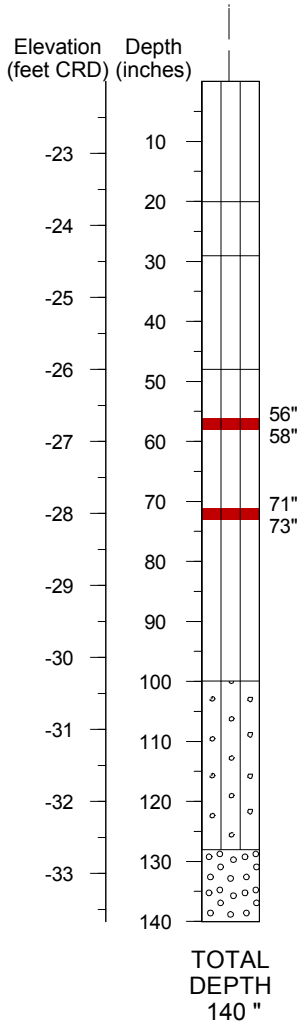


Bands of black sediment that has strong PAH odor and sheen at 53-56", 63", 64", 75", 77", 81", 92" and 96". [Core photo used to determine bands > 2 inch thick]

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 4/19/2008
Mudline Elevation (feet CRD): -22
Latitude (deg): 45.58213783
Longitude (deg): 122.7627492

SDDA-19

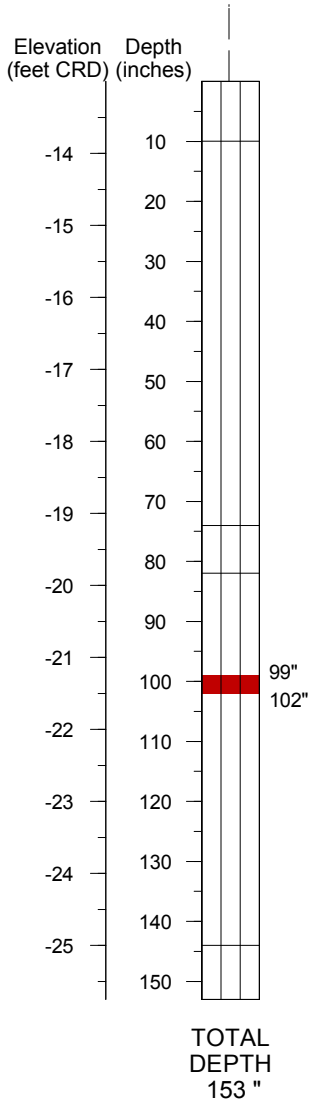


Cohesive, silty clay with occasional thin stringers of very fine sand. Silty clays are banded with black bands with strong coal tar odor and slight sheening. Bands are at 50", 56", 59", 63.5", 67", 71", 76", with mineralized PAH parting planes within the 63.5" and 71" bands.
[Core photo used to determine bands > 2 inch thick]

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 4/19/2008
Mudline Elevation (feet CRD): -13
Latitude (deg): 45.58180583
Longitude (deg): 122.7625263

SDDB-20

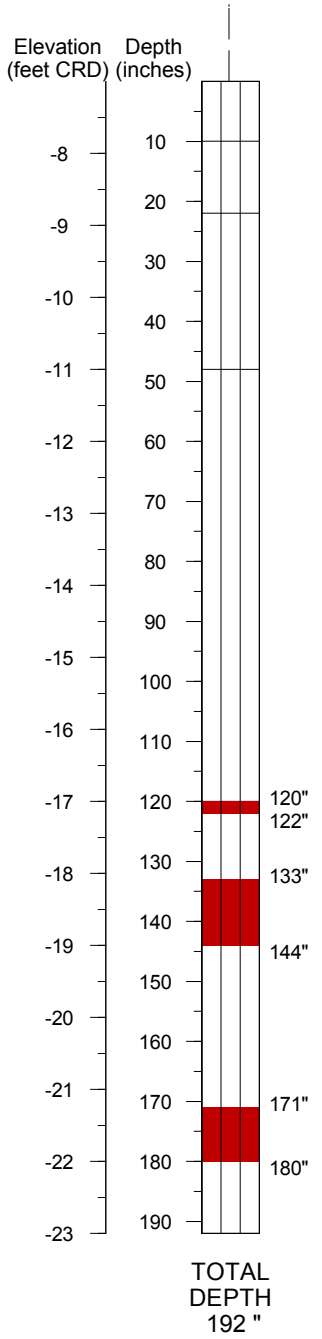


Banded, cohesive, silty clay with black bands that have diffuse sheen and strong PAH odor at 99-102", 111", 112", 118", 119", 120", 125", 128", 129-130". Bands are thin (<0.5") unless noted as a range.

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 4/20/2008
Mudline Elevation (feet CRD): -7
Latitude (deg): 45.58140267
Longitude (deg): 122.761893

SDDC-23



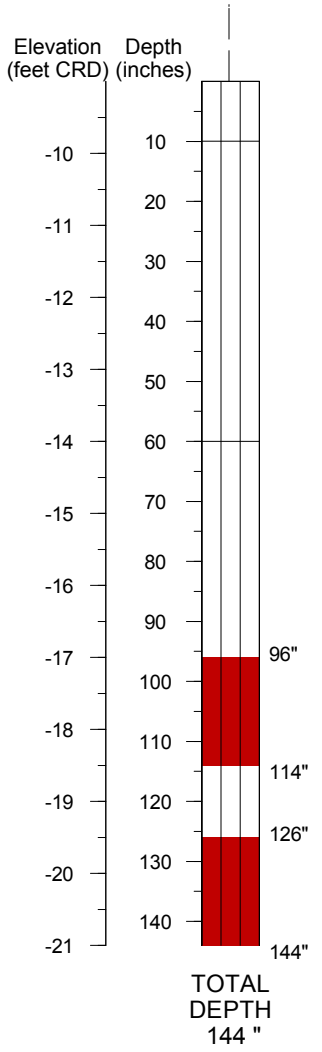
120-144". Banded black and brown silty clay with laminar lenses of wood particles. Very strong PAH/coal tar odor. No free NAPL but widespread irredescent sheen in 0.1-0.25 florets.
[Core photo used to determine bands > 2 inch thick]

171-180" thick band of black, PAH enriched sediment with strong odor.

Enclosure

Project: US Moorings
Location: Portland,Oregon
Date Drilled: 4/19/2008
Mudline Elevation (feet CRD): -9
Latitude (deg): 45.5812595
Longitude (deg): 122.7620083

SDDC-24



96-114". Loose, wet, black, woody silt with H2S and coal tar odors. Strong. Sheen in abundant 0.2" florets.

126-144". Laminated, black, organic silty clay with wood fragments, sheen and strong PAH odor. Several laminar bands have mineralized PAH parting planes.

Enclosure

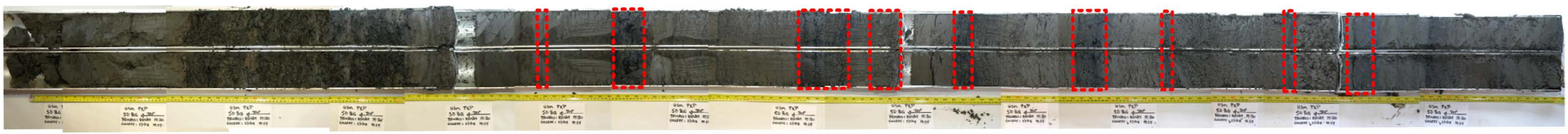
Attachment 2

Core Photographs

20BF

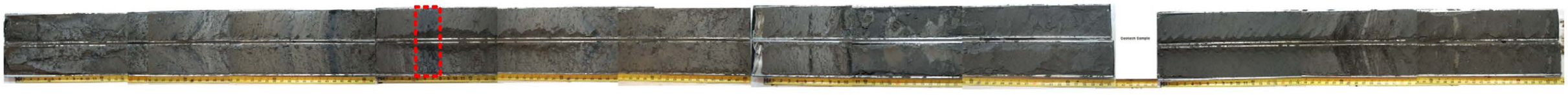
43BB

50BG



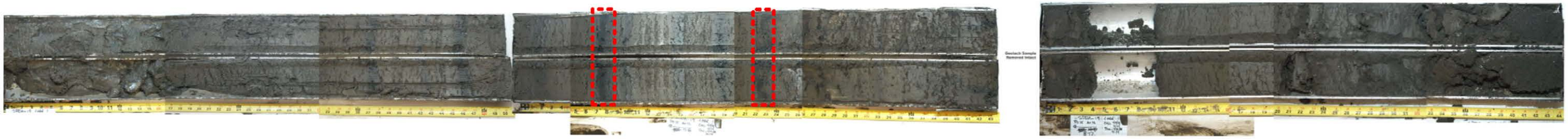
53BD

SDDA-18



Zone identified as containing substantial product

SDDA-19



SDDB-20

SDDC-23

SDDC-24

Zone identified as containing substantial product

Attachment 3

Core Logs from the Remedial Investigation and Supplemental Investigation

Major Divisions		Symbols	Typical Names
Coarse Grained Soils (More than 1/2 of soil >No. 200 sieve size)	Gravels (More than 50% coarse fraction > no. 4 sieve	GW	Well-graded gravels or gravel-sand mixtures, little to no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little to no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels or gravel-sand-clay mixtures
	Sands (Less than 50% coars fraction > no. 4 sieve)	SW	Well-graded sands or gravel-sand mixtures, little to no fines
		SP	poorly-graded sands or gravelly sands, little to no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine Grained Soils (More than 1/2 of soil <No. 200 sieve size)	Silts & Clays Liquid limit* less than 50%	ML	Inorganic silts and very fine sands, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy or silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts & Clays Liquid limit* greater than 50%	MH	Inorganic silts, micaceous or ditomaceous fine sand or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clay, organic silts
Highly Organic Soils		Pt	Peat or other highly organic soils

*Liquid limit represents the moisture contnet (in percent) of a soil at which point the soil no longer behaves like a plastic and starts to behave like a liquid.

Boring Log Symbols

Sample Interval

Groundwater, First Observed

Groundwater, Static

Sample Types

SS	Split Spoon
G	Grab
ST	Shelby Tube
GS	Geoprobe Sampler

Sheen Types

NS	No Sheen Observed
SS	Slight Sheen observed (Spotty coverage of sheen pan, no
MS	Moderate Sheen (Full Coverage)
HS	Heavy Sheen (Full Coverage, Irredescent)

Sample Moisture

Dry	No Moisture, dry to touch
Moist	Damp but no visible moisture
Wet	Visible free water

Sample Plasticity (Fine-Grained Soils)

Non-Plastic - Cannot be rolled at any moisture content

Low - Barely rolled, lump cannot be formed when drier than plastic limit

Medium - Easily rolled, lump crumbles when drier than plastic limit

High - Easily rolled yet takes considerable time to reach the plastic limit, lump can be formed without crumbling when drier than the plastic limit

Partical Size Range (Course-Grained Soils)

Gravel - Fine, Coarse

Sand - Fine, Medium, Coarse

Based on Unified Soil Classification System and ASTM Standard D2487 and D2488

Core Location F

BORING NUMBER	20 BF
PROJECT	US Moorings PRP Study
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
F-SS20-BF-0	0	5		N			**0-10 cm. 7.5YR 3/2. Slightly soft, silty (30%) clay (70%).**
				N	20		Acrid decomposing organics odor.
				N			**10-69 cm. 2.5Y 3/2. Slightly soft, moist, organic (<5%), silty (20-30%) clay (70-80%).**
				N			Cohesive, plastic and slight acrid decomposing organics odor. No sheen visible with
				N	40		application of water. Homogeneous.
				N			
F-SS20-BF-24	58	63		N	60		**69-184 cm. 2.5Y 3/2. Soft, moist, organic (<5%), very clayey (40-50%) silt (50-60%)**
				N			with trace (<1%) very fine sand. Slight organic odor. No sheen could be produced with
				N	80		application of water.
				N			
				N	100		
				N			
				N	120		
				N			
				N	140		
				N			
				N	160		
F-SS20-BF-66	165	170		N			
				N	180		
				N			**184-228 cm. 2.5Y 3/2. Slightly firm, consolidated, moist, organic (<5%), very clayey**
				N	200		**(40-50%) silt (50-60%)** with trace (<1%) very fine sand.
				N			Slight coal tar odor. No sheen could be produced with application of water.
				N	240		**228-374 cm. 2.5Y 3/2. Slightly soft, plastic, moist to damp, organic (<1%)**
				MS			**silty (15-20%) clay (80-85%).**
				MS	260		Slight coal tar odor in upper portion of unit. Black, laminar bands at:
				MS			225-228 cm with moderate to strong coal tar odor
				MS	280		244-245 cm with strong coal tar odor
				MS			267-269 cm strong coal tar odor and blue ropy sheen produced with application of water.
F-SS20-BF-116	292	297		MS	300		288-295 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			315-315.5 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS	320		319-320 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 13 feet
Recovery: 100%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

BORING NUMBER	20 BF
PROJECT	US Moorings PRP Study
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				MS			In black layers, sheen can also be produced in situ with application of pressure on sediment.
				MS			
F-SS20-BF-146	344	349		MS	340		333-341 cm interval is slightly sandy (<10%) and has slight vanillin odor in addition to strong
				MS			coal tar odor.
				MS	360		366-373 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			
					374		**374 cm EOC**

		Notes:
Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Penetration: 13 feet
Coring Method	Vibracore	Acquisition: 13 feet
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Recovery: 100%
Core Collected		
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

Core Location B

BORING NUMBER	43BB
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
B-43-BB-0	0	5		N			**0-99 cm. 2.5 3/1. very silty (40-50%) clay (50-60%)**
				N	20		Soft, moist, organic, plastic, with scattered organic/plant fragments throughout.
				N			Homogeneous. Slight natural organic odor. No sheen could be produced with
				N	40		application of water.
				N			
B-43-BB-24	58	63		N			
				N	60		
				N			
				N	80		
				N			
				N	100		
B-43-BB-40	99	104		SS			**99-112 cm. 2.5Y 3/2. Slightly silty (10-15%) fine sand (85-90%) trace organics (<5%).**
				SS	120		Stiff, damp to dry, in situ sheen at 110.5 cm, moderate coal tar odor ad small (1-2mm) blebs of
				MS			brown NAPL and ropy sheen can be floated out with application of water.
				MS	140		**112-189 cm. 2.5Y 3/1. silty (30-40%) clay (60-70%) with trace (<5%) organics**
				MS			Soft, moist, plastic, with preserved methane vesicles. 1-2 mm lenses of organic particles at
				MS	160		131 and 137 cm. Slight coal tar odor and natural organic odor. 170-179 cm florets of sheen
				MS			can be produced by streaking sediment and sheen can prodiced from this usit with application
				SS	180		of water.
				MS			
				SS	200		**189-214 cm. 2.5Y 3/1. organic (>20% wood), fine sandy (20-30%), silt (50-60%).**
B-43-BB-78	196	201		SS			Soft, moist to wet, wood present as fragments, strong coal tar odor and 1-3 cm streak
				N	220		of in situ dull sheen.
				N			**214-343 cm. Gley 1 10Y 2.5/1. Fine sandy (10-20%) clayey (30-40%) silt (50-60%)**
				N	240		Soft to slightly firm, damp, intercollated sand present as discrete laminar stringers/lenses.
				N			Stringers/lenses of sand at 214-248 cm, 301-302 cm, 309-325 cm. Slight decaying
				N	260		organics odor. No sheen produced with application of water.
				N			
				N	280		
				N			
B-43-BB-116	292	297		N	300		
				N			

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 11.5 feet
Recovery: 88.5%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

BORING NUMBER	43BB (continued)
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION							DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)	STRATA	USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**214-343 cm. Gley 1 10Y 2.5/1. Fine sandy (10-20%) clayey (30-40%) silt (50-60%)**
				N	320		
				N			
				N	340		
				N			**343 cm EOC**
					360		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 11.5 feet
Recovery: 88.5%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

Core Location G

BORING NUMBER	50BG
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
G-5--BG-0	0	5		N			**0-44 cm. 2.5Y 4/2. Slightly silty (15-20%) clay (80-85%).**
				N			Stiff, dry to slightly damp. 10-12 cm band of small (<0.5 cm) organic fragments
				N	20		(root/plant particles). Natural organic odor. No sheen produced with application of water.
				N			
				MS	40		**44-104 cm. Gley 1 2.5/N. Very clayey (40-50%) wood (50-60%).**
				MS			Black, soft, moist. Wood particles are mechanically fragmented and many have a blue coating
G-50-BG-26	66	71		MS	60		that becomes more pronounced with increased time exposed to air. Strong tar odor.
				MS			Minor sheen produced with application of water.
				MS	80		
				MS			
				MS	100		
				MS			**104-427 cm. 2.5Y 2.5/1. Slightly silty (20%) clay (80%).**
				MS			Trace fine sand (<1%). Enitire unit is sompositionally similar in terms of sediment type.
				MS	120		Numerous depositional bands in unit.
				MS			136-136.5 cm. Band of wood/plant fragments with coal tar odor.
				HS	140		140-142.2 cm. Black stained sediment band in laminar orientation. NAPL.
				HS			
				HS	160		161-170 cm, Black, woody, strong coal tar odor.
				HS			
G-50-BG-72	182	188		HS	180		
				HS			191-192. Black stained sediment and mineralized NAPL plane. Very strong coal tar odor.
				HS	200		
				HS			213-227 cm. Black, organic, in-situ sheen and strong coal tar and naphthalene odors.
				HS	220		
				HS			233-240 cm. Very strong naphthalene odor. NAPL and blue sheen with application of water.
				HS	240		240-245 cm. Air pocket/void.
G-50-BG-98	249	254		HS			245-256 cm. Strong to overwhelming naphthalene odor. In-situ sheen with pressure.
				HS	260		256-261 cm. In-situ sheen, mineralized NAPL bands, very strong naphthalene odor. NAPL.
				HS			261-290 cm. 2.5Y 3/2. Moist. Very strong coal tar and naphthalene odor.
				HS	280		
G-50-BG-116	295	300		HS			290-299 cm. Black, dense in situ sheen. Very strong coal tar odor.
				HS	300		299-315 cm. 2.5Y 3/2. Moist. Very strong coal tar and naphthalene odor.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes:
Coring Method	Vibracore	Penetration:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Acquisition:
Core Collected	19-April-2008	Recovery:
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

BORING NUMBER	50 BG
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				HS			
				HS	320		315-317 cm. Black, strong in situ sheen and NAPL. Very strong coal tar and naphthalene odor.
				HS			317-350 cm. 2.5Y 3/2. Silty (20%) clay (80%) with strong coal tar odor.
				HS	340		slightly soft, plastic.
				HS			
				HS	360		350-352 cm. Black, in-situ sheen, NAPL, very strong coal tar odor.
				HS			352-367 cm. In-situ sheen and very strong coal tar odor.
G-50-BG-146	370	376		HS	380		367-374 cm. Black, in situ sheen. Strong coal tar odor.
				HS			380 cm. Plane of mineralized NAPL.
				MS	400		390-391 cm. Laminar black band with in-situ sheen and very strong coal tar odor.
				MS			391-427 cm. Slightly soft, plastic, damp to moist silty (15-20%) clay (80-85%). Moderate
				MS	420		coal tar odor.
							427 cm EOC
					440		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes:
Coring Method	Vibracore	Penetration:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Acquisition:
Core Collected		Recovery:
COORDINATES		
SURFACE ELEVATION		Cores archived frozen since collection and thawed prior to Processing
DATUM		Core not expanded based on compaction during processing

Core Location D2

BORING NUMBER	53BD
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
D2-53-BD-0	0	5		N			**0-20 cm. 2.5Y 3/3. Silty (40%) clay (60%).**
				N			Dry, soft, natural organic odor. Texture has been modified by freezing/thaw.
				N	20		**20-363 cm. 5Y 2.5/1. Trace sandy (<5%), silty (30-40%) clay (55-70%).**
				N			Bulk unit, soft, cohesive, slightly plastic. Moist. Multiple substrata
				N	40		
D2-53-BD-24	61	66		N			58 cm. Vesiculated slag with PAH odor. No sheen produced with application of water.
				N	60		
				N			71 cm. Coal tar odor, no sheen produced with application of water.
				N	80		
				N			
				Y	100		
				Y			
				N	120		125 cm. 1 mm stringer of sand, coal tar odor.
				N			
				N	140		
				N			
				N	160		
				N			
				N	180		
				N			183 cm. Laminar stringer/parting plane of very fine sand.
				N			195-199 cm. Silty (30%) fine sand (70%) with distinct coal tar odor.
D2-53-BD-83	211	216		SS	200		205-212 cm. Loose, wet layr of wood and plant particles. Strong coal tar odor. Sheen can
				N			be produced as ribbons with application of water.
				N	220		
				N			
				N	240		
				N			
				N	260		
				N			
				N	280		
				N			
				SS	300		295 cm. Laminar band of black sediment with stron coal tar odor. Sheen produced with
D2-53-BD-118	300	305		SS			application of water.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration:
Acquisition:
Recovery:

Cores archived frozen since collection and thawed prior to Processing

Core not expanded based on compaction during processing

BORING NUMBER	53BD
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION							DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)	STRATA	USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**20-363 cm. 5Y 2.5/1. Trace sandy (<5%), silty (30-40%) clay (55-70%).**
				N	320		
				N			
				N	340		
				N			357-363 cm. Black stained band of sediment with strong coal tar odor and sheen can
D2-53-BD-143	363	368		HS	360		be produced in-situ with application of pressure.
							363 cm EOC
					380		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes: Penetration:
Coring Method	Vibracore	Acquisition:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Recovery:
Core Collected		
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

BORING NUMBER	SDDA-18 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N	12		Wet, unconsolidated silty clay (30/70) with scattered very minor fine sand. Petroleum odor.
				SS			**10-10.75"**
				SS	24		Black band of poorly graded sandy silt (40/60) with strong petroleum odor and sheen.
				SS			Mineralized parting plane
				SS	36		**10.75-48" SILTY CLAY (ML)**
				SS			Soft, brownish olive-gray, methanogenic, mosit silty/clay (30/70) with thin (<1") sand stringers.
				SS	48		Bands of black sediment throughout unit and banded sediment has stong PAH oder. Bands
				SS			are 0.1-0.2 " thick and are at 24",26",30",31",38",41",43",44" below mudline.
				SS	60		**48-90" SILTY CLAY (ML)**
				SS			Soft, slightly cohesive silty clay that is moist and methanogenic. Varies from brown to black.
				SS	72		Interbedded stringers of silt and sorted very fine sand 58-59", 61.5", 71", 76" and 82".
				SS			Stringers are 0.25" thick at maximum. Bands of black sediment that has strong PAH odor and
				SS	84		sheen at 53-56", 63", 64", 75", 77",81"92" and 96". Mineralized PAH parting plane in 63" band.
				SS			
				SS	96		
				SS			**96-109" SILTY CLAY (ML)**
				SS	108		Soft, moist, cohesive, plastic, silty clay (30/70) with black band having mineralized PAH parting
				N			planes at 102" and 107".
				N	120		**109-138" SAND (SW)**
				N			Soft, damp, well-sorted, uniformly graded, gray fine sand with clasts of silty clay.
				N	132		No odor, no sheen.
				N			
					144		**138-144"- Not logged. Retained intact for geotech sample.**
				N			**144-167" SAND (SW)**
				N	156		Soft, damp, well-sorted, uniformly graded, gray fine sand with clasts of silty clay.
				N			No odor, no sheen.
				N	168		**167-174 Peat (Pt)**
				N			Peaty, oganic silt with laminar wood, root and plant fragments. Compact, wet.
				N	180		**174-197" SAND (SW)**
				N			Firm, well-sorted, uniformly graded fine sand with rip-up clasts of cohesive brown clay.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	20-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 19 ft
Acquisition: 16.8 ft
Recovery: 88%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDA-19 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-20" SILTY CLAY (ML)**
				N	12		Unconsolidated. Wet, homogeneous, very silghtly sandy, clayey silt (5/30-35/60-70)
				N			becoming slightly more consolidated with depth.
				N	24		**20-29" SILTY CLAY (ML)**
				N			Soft, wet, highly organic, silty clay with >20% wood by volume and PAH odor.
				N	36		**20-48" SILTY CLAY (ML)**
				N			Intercollated, slightly fine sandy silt and clay. 0.5 to 0.75 bands of black clay with moderate to
				N	48		strong PAH odor at 38", 42: and 46". Stringer of fine sand at 48".
				SS			**48-100" SILTY CLAY (ML)**
				SS	60		Cohesive, silty clay (30/70) with occasional thin stringers of very fine sand. Silty clays are
				SS			banded with black bands with strong coal tar ofor and slight sheening. Bands are at
				SS	72		50", 56", 59", 63.5 ", 67",71", 76", with mineralized PAH parting planes within the 63.5" and
				SS			71" bands. Three hard, 0.25 " dia. cohesive clay clasts at 78". Number of fine sand
				SS	84		stringers increases between 84-90"
				SS			
					96		90-96" Not logged. Retained intact for geotech sample.
							100-128" SAND (SM)
					108		Firm, moist, dark brown, silty fine sand (30/70) with very minor clay subcomponen that is
							present in intercollated lenses. No odor, no sheen.
					120		**128-140 SAND (SW)**
							Firm, damp, well-sorted, uniformaly graded, very fine sand. No odor, no sheen.
					132		
							EOC
					144		
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 15 ft
Acquisition: 12 ft
Recovery: 80%

Core expanded based on compaction during processing
Material in core catcher discarded.

Enclosure

BORING NUMBER	SDDB-20
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, olive-brown silty clay. Unconsolidated and almost fluid. Methane vesicles and no
				N	12		odor.
				N			
				N	24		
				N			
				N			**10-74" SILTY CLAY (ML)**
				N	36		Very soft, olive brown, silty clay (30/70) with methane vesicles and small organic/plant
				N			fragments scattered throughout. Slightly plastic in upper portion and grades to plastic at
				N	48		**46"-74".SILTY CLAY (ML)**
				N			
				N	60		
				N			
				N			**74-82" SILTY CLAY (ML)**
				N	72		Black to brown, soft, cohesive, pastic, silty clay with PAH odor. Black band at 74"-75".
				SS			
				SS	84		
							90-96" Not logged. Retained intact for geotech sample.
					96		
				SS			**82"-144" SILTY CLAY (ML)**
				SS	108		Banded, cohesive, silty clay with black bands that have diffuse sheen and stron PAH odor at
				SS			99-102", 11", 112", 118", 119", 120", 125", 128", 129-130". Bands are thin (<0.5") unless
				SS	120		noted as a range.
				SS			
					132		**133-140" Gap in sample**
				N			**140-153" SILTY CLAY (ML)**
				N	144		Cohesive, interbedded, fine sandy silt and clay.
					156		**EOC**
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 13:30
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 ft
Acquisition: 13 ft
Recovery: 100%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDC-23
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	23-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, unconsolidated, slightly silty clay (20/80).. No odor.. Wood and plant fragments.
				N	12		**10"-22" SILTY CLAY (ML)**
				N			Soft, wet, silt with methane vesicles and slight PAH odor.
				N	24		**22-48" SILTY CLAY (ML)**
				N			Soft, organic silt with methane vesicles and scattered small (<0.5") plant fragments.
				N	36		Black bands at 30-32" that have no odor.
				N			
				N	48		**48-120" SILTY CLAY (ML)**
				N			Soft, slightly plastic, organic silty clay (30/70) with methane vesicles and homogenous
				N	60		texture. Occasional thin (<0.25") laminar bands of oprganics (plant fragments)
				N			
				Y	72		72-84" Black organic inclusion that contain wood fragments and have PAH odor.
				N			
				N	84		
				N			
				N	96		100" cored through wood fragment
				N			
				Y	108		
				Y			108-120 Sediment becomes darker, sheening occurs and strong PAH odor.
				Y	120		**120-144" SILTY CLAY (ML)**
				Y			Banded black and brown silty clay (30/70) with laminar lenses of wood particles. Very strong
				Y	132		PAH/coal tar odor. No free NAPL but widespread irresescent sheen in 0.1-0.25 florets.
					144		
				Y			**144-150 Retained intact for geotech sample**
				Y			**150-180" SILTY CLAY (ML)**
				Y	156		Firm, moist, plastic, organic silty clay (30/70) with laminar black bands at 153-156",
				Y			162", 163". Each band 0.2" thick and has strong sheening and strong to overwheming
				Y	168		PAH/Coal tar odor. 171-180" thick band of black, PAH enriched sediment with strong odor.
				Y			**180-192" SILTY CLAY (ML)**
					180		Hard, intercollated blAck to brown silty clay with laminar bands oF organics/wood/plant. **EOC**.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	20-April-2008 10:24
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 19 ft
Acquisition: 16.4 ft
Recovery: 86%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDC-24
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	21-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, unconsolidated, slightly silty clay (30/70) with slight natural organic odor.
				N	12		**10"-60" SILTY CLAY (ML)**
				N			Soft, moist to wet, organic, silty clay (30/70) with methane vesicles and becomes slightly
				N	24		firmer with increasing depth.
				N			
				N	36		
				N			
				N			
				N	48		
				N			
				N			
				N	60		
				N			**60-126" SILTY CLAY (ML)**
				N			Layered silty clay (30/70) with black banding at 76" that has strong coal tar odor.
				SS	72		
				SS			
				SS			
				SS	84		
				SS			Wood lens.
				MS	96		**96-114" SILTY CLAY (ML)**
				MS			Loose, wet, black, woody silt with H2S and Coal tar odors. Strong. Sheen in abundant 0.2 "
				MS	108		florets.
							114-120" - Not logged. Retained intact for geotech sample
					120		
				MS			124" Void in core that extended into geotech sample.
				MS			**126-144" SILTY CLAY (ML)**
				MS	132		Laminated, black, organic silty clay with wood fragments, sheen and strong PAH odor.
				MS			Several laminar bands have mineralized PAH parting planes.
					144		**EOC**
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 14:12
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 15 ft
Acquisition: 13 ft
Recovery: 87%

Core expanded based on compaction during processing
Material in core catcher discarded.

Attachment 4

Summary of Bulk Chemical Characteristics in Subsurface Sediment Cores

Attachment 4. Summary of the bulk chemical characteristics in subsurface cores

Field ID	Core Depth	TPAH (µg/Kg)	LPAH (µg/Kg)	HPAH (µg/Kg)	Σ Biomarkers (µg/Kg)	TPH (mg/Kg)	Core Descriptions
A-52-BA-0	0" - 2"	5,050	1,370	3,680	418	485	
A-52-BA-18	18" - 20"	10,200	2,730	7,470	776	466	115-118 cm. **1 cm bleb of in-situ sheen at top of unit** and is associated with wood fragment.
A-52-BA-28	28" - 30"	36,000	15,900	20,100	1,100	631	
A-52-BA-54	54" - 56"	12,800	3,840	8,950	2,580	953	
B-43-BB-0	0" - 2"	20,200	8,320	11,800	435	379	99-112 cm. in situ sheen at 110.5 cm, **moderate coal brown NAPL and ropy sheen can be floated** out with application of water. t**ar odor and small (1-2mm) blebs of brown NAPL and ropy sheen can be floated out with application of water.** 112-189 cm, preserved methane vesicles. Slight coal tar odor and natural organic odor. 170-179 cm florets of sheen can be produced by streaking sediment and sheen can prodiced from this usit with application of water. **189-214 cm - strong coal tar odor and 1-3 cm streak of in situ dull sheen**.
B-43-BB-24	24' - 26"	13,400	3,190	10,200	848	615	
B-43-BB-40	40" - 42"	356,000	201,000	154,000	708	1,000	
B-43-BB-78	78" - 80"	1,850,000	901,000	953,000	9,090	7,080	
C-42-BC-0	0" - 2"	17,500	4,510	13,000	315	330	153-172 cm slight PAH odor and **thin ropy blue sheen** can be produced with application of water, otherwise no sheen elsewhere. 172-221 cm - **strong coal tar odor. 1-2 mm blebs of product and stringer, sheen** with application of water. 276-276.5, 287-291, 325-328, and 358-362 cm. **black laminar bands** of compositinally identical sediment with moderate strong coal tar odor. **Strong odor a**t 358-362 cm unit. **Sheen** can be produced with application of water in these units.
C-42-BC-24	24' - 26"	29,200	7,490	21,700	2,050	774	
C-42-BC-82	82"- 84"	280,000	160,000	120,000	3,170	1,840	
C-42-BC-114	114" - 116"	185,000	94,900	90,200	6,730	2,570	
D2-53-BD-0	0" - 2"	7,040	2,050	4,990	423	488	
D2-53-BD-24	24' - 26"	584,000	190,000	394,000	786	1,460	58 cm - vesticulated slag with PAH odor. 71 cm - Coal tar odor. 125 cm - 1 mm stringer of sand, coal tar odor. 195-199 cm - distinct coal tar odor, 205-212 cm - **strong coal tar odor**, **sheen** can be produced as ribbons with application of water. 295 cm - **laminar band of black sediment with strong coal tar odar**, **sheen** produced with application of water. 357-363 cm B**lack strained band of sedimen**t w**ith strong coal tar odor** and **sheen** can be produced in-situ with application of pressure.
D2-53-BD-83	83" - 85"	378,000	235,000	142,000	1,200	1,410	
D2-53-BD-118	118"- 120"	189,000	117,000	72,000	821	907	
E-40-BE-0	0" - 2"	121,000	33,000	88,100	871	680	109-139 cm - **strong coal tar odor. Blue strings of sheen** produced with application of water. 139-193 cm - Clay clasts have st**rong coal tar odor** and **ropy blue sheen ca**n be proudced with application of water.
E-40-BE-24	24' - 26"	97,700	27,900	69,700	2,520	1,130	
E-40-BE-52	52" - 54"	225,000	87,900	137,000	1,540	1,290	

Enclosure

Attachment 4. Summary of the bulk chemical characteristics in subsurface cores

Field ID	Core Depth	TPAH (µg/Kg)	LPAH (µg/Kg)	HPAH (µg/Kg)	Σ Biomarkers (µg/Kg)	TPH (mg/Kg)	Core Descriptions
F-SS20-BF-0	0" - 2"	26,200	5,760	20,500	477	572	184-228 cm - slight coal tar odor. 228-373 cm - slight coal tar odor, **black laminar bands** at 225-228 cm with **moderate to strong coal tar odor.** 244-245 cm with **strong coal tar odor.** 267-269, 288-295 cm , 315-315.5 cm, 319-320 cm **strong coal tar odor and blue ropy sheen** produced with appliation of water. In **black layers, sheen** can also be produced in sit with applicatin of pressure. 333-341 cm **slight vanillin odor** in addition to **strong coal tar odor.** 366-373 cm s**trong coal tar odor and blue ropy sheen** produced with applicaiton of water.
F-SS20-BF-24	24' - 26"	19,600	7,630	12,000	542	307	
F-SS20-BF-116	116" - 118"	1,060,000	719,000	336,000	5,290	4,860	
F-SS20-BF-146	146" - 148"	235,000	115,000	120,000	6,090	2,320	
G-50-BG-0	0" - 2"	36,100	17,700	18,400	781	337	
G-50-BG-26	26" - 28"	2,110,000	944,000	1,170,000	859	4,080	44-104 cm - **wood particles a**re mechanically fragmented and many have **blue coating that becomes more pronounced with increased time exposed to air. Strong tar ordor.** Minor sheen with water. 104-427 cm - **numerous dopositional bands** in unit. 136-136.5 wood/plant fragements with **coal tar odor,** 140-142.2 cm **black stained sediment band in laminar orientation. NAPL.** 161-170 cm **black woody strong coal tar odor.** 191-192 cm **black stained sediment and mineralized NAPL plane. Very strong coal tar odor.** 213-227 cm - b**lack organic in-situ sheen and strong oal tar and napthalene odors.** 233-240 cm - v**ery strong napthalene odor. NAPL and blue sheen with application of water.** 245-256 cm - **strong to overwhelming napthalene odor. In situ sheen with pressur**e. 256-261 cm. **In situ sheen , mineralized NAPL bands, very strong napthalene odor. NAPL.** 261-299 cm **Black dense in situ sheen. Very strong coal tar odor.** 299-315 cm - **very strong coal tar and napthalene odor.** 315-317- cm - **black strong in insitu sheen and NAPL. Very strong coal tar and napthalene odor.** 317-350 cm - **strong coal tar odor**. 352-367 cm - **in situ sheen and very stron coal tar odor.** 367-374 cm - **black in situ sheen - strong coal tar odor.** 380 **Plane of mineralized NAPL.** 390-391 cm - **laminar black band with in-situ sheen and very strong coal tar odor.** 391-427 cm moderate coal tar odor.
G-50-BG-72	72" - 74"	409,000	257,000	151,000	922	1,110	
G-50-BG-98	98" - 100"	1,830,000	1,170,000	653,000	2,910	3,660	
G-50-BG-116	116" - 118"	5,870,000	2,720,000	3,150,000	7,040	13,000	
G-50-BG-146	146" - 148"	3,860,000	1,950,000	1,910,000	14,800	12,100	
SDUD-1-1	0" - 12"	298,000	69,500	228,000	481	1,140	
SDUD-1-2	12" - 24"	98,700	36,400	62,300	276	338	
SDUD-2-1	0" - 12"	158,000	37,100	122,000	525	700	
SDUD-27-1	0" - 12"	148,000	35,200	113,000	452	812	
SDUD-27-2	12" - 24"	464,000	176,000	289,000	1,910	1,470	

Enclosure

Attachment 4. Summary of the bulk chemical characteristics in subsurface cores

Field ID	Core Depth	TPAH (µg/Kg)	LPAH (µg/Kg)	HPAH (µg/Kg)	Σ Biomarkers (µg/Kg)	TPH (mg/Kg)	Core Descriptions
SDDA-18-28	28" - 30"	527,000	345,000	182,000	2,910	2,570	1-10" - **Petrouleum odor**. 10-10.75 " **black band with strong petroleum odor and sheen. Mineralized parting plane**. 10-75-48" **Bands of black sediment throughout unit and banded sediment has strong PAH odor.** 40-90" - **Bands of black sediment that has strong PAH odor and sheen. Mineralized PAH parting plane in 63" band.** 96-109" - **mineralized PAH parting planes** at 102 and 107".
SDDA-18-58	58" - 60"	634,000	366,000	267,000	7,300	4,290	
SDDA-18-106	106" - 108"	3,110,000	1,750,000	1,370,000	7,470	9,600	
SDDA-19-58	58"-60"	302,000	145,000	156,000	8,560	3,880	20-29" **PAH odor.** 20-48" b**ands of black clay with moderate to strong PAH odor** at 38", 42 and 46". 48-100" - b**anded with black bands with strong coal tar odor and slight sheening.** With **mineralized PAH parting planes**.
SDDA-19-72	72" - 74"	428,000	208,000	220,000	3,590	2,510	
SDDB-20-3	24" - 36"	80,900	30,400	50,500	1,320	920	1-74" - Methane vesicles. 74-82" - **PAH odor with black bands**. 82-144" - **black bands that have diffuse sheen and strong PAH odor**.
SDDB-20-4	36" - 48"	231,000	149,000	81,700	2,680	1,530	
SDDB-20-111	111" - 113"	324,000	192,000	132,000	4,270	2,320	
SDDB-20-129	129" - 130"	538,000	313,000	225,000	6,290	3,380	
SDDB-21-132	132" - 134	71,100	32,800	38,300	2,470	1,280	10-48, 54-118" - methane vesicles. 118-144" - scattered minor black sediment and **PAH odor**.
SDDB-22-3	24" - 36"	224,000	83,000	141,000	2,940	1,550	10-60" methane vesicles. 33" **thin black band** and slight PAH odor., 42" **black band.** 66-96" **darkest patches of sediment have PAH odor**.
SDDC-23-3	24" - 36"	562,000	443,000	120,000	3,430	2,720	10-22" - methane vesicles and slight PAH odor. 22-48" - **black bands** . 48-120" t**hin laminar bands of organic**s. 72-84" - black organic inclusion that contain wood fragments and have **PAH odor**. 108-120" - **Sediment becomes darker sheening occurs and strong PAH odor**. 120-144" - Banded black and brown silty clay with laminar leanses of wood particles. V**ery strong PAH/coal tar odor**. No free NAPL but **widespread inesesent sheen in 0.1-0.25 florets**. 162 - 163 - each band is 0.2 " thick and has a **strong sheening and strong to overwheming PAH .Coal tar odor.** 171-180" t**hick band of black, PAH enriched sediment with strong odor.** 180-192" laminar bands of organic/wood/plant.
SDDC-23-4	36" - 48"	228,000	109,000	118,000	4,570	1,900	
SDDC-24							10-60" - methane vesicles. 60-126" - **black banding** at 76" that has **strong coal tar odor**. 96-114" - black, woody silt with H2S and **coal tar odors**. **Strong sheen.** 126-144" - laminated balck organic silty clay with wood fragment**s sheen and strong PAH odor**. Se**veral laminar bands have mineralized PAH parting planes.**

Enclosure

Attachment 4. Summary of the bulk chemical characteristics in subsurface cores

Field ID	Core Depth	TPAH (µg/Kg)	LPAH (µg/Kg)	HPAH (µg/Kg)	Σ Biomarkers (µg/Kg)	TPH (mg/Kg)	Core Descriptions
SDDC-25-1	0" - 12"	1,460,000	400,000	1,060,000	1,890	3,730	Core 2. 0-24" - **PAH odor.** 24-48" - methane vesicles an d layer has **strong PAH odor**. 58-61" - strong H2S odor and slight PAH odor. 64" -**Bands of black, PAH enriched sediments with mineralized PAH plane**. 78-87" H2S and **PAH odors** with wood fragments.
SDOF-28							5-48" slight limey/calcic odor. Methane vesicles. 48-96" - methane vesicles. 96-112" - methane vesicles, 0.5" t**hick black layers that have sheen and strong PAH odor**.

Notes:

Highlight indicates sediment core with substantial product.

Bold in core description indicates observation associated with product

Enclosure

Attachment C

Anchor QEA Review of USACE Substantial Product Letter

ANCHOR QEA

6650 SW Redwood Lane, Suite 333
Portland, Oregon 97224
Phone 503.670.1108

September 24, 2012

Sean Sheldrake, Project Coordinator
EPA, Region 10
1200 Sixth Avenue, M/S ECL-111
Seattle, Washington 98101

Re: NW Natural Review of USACE Memorandum Dated July 27, 2012, Regarding Presence of Substantial Product at U.S. Moorings Site

Project Number: 000029-02.28

Dear Sean:

NW Natural received an electronic copy of an U.S. Army Corps of Engineers (USACE) July 27, 2012 memorandum submitted to the U.S. Environmental Protection Agency (EPA) regarding the potential presence of substantial product located at the U.S. Government Moorings (U.S. Moorings) site. This letter provides a summary of NW Natural's technical review of the USACE memorandum as it relates to the nearby upstream Gasco Sediment Site.

The July 27, 2012 USACE memorandum summarizes USACE's interpretation of USACE collected sediment core information and concludes that "substantial product" is present outside the Interim Project Area defined by the Draft Engineering Evaluation/Cost Analysis (Draft EE/CA). The Gasco Sediment Site Statement of Work (SOW) defines "substantial product" as:

1. *Bands of product, layers of product, "saturated" sediments, "stained" sediments, and/or seams of product that are greater than 2 inches thick.*
2. *Any layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., "oozes" or "drips" out of the core during core observations).*

Modifying factors to this definition are:

3. *If top 5 ft of core has no substantial product under Criteria #1, then deeper product should be judged as "not substantial", even if relatively thick layers of product exist at greater depths.*
4. *If there are any seams of mobile liquid NAPL (not solid or semisolid tar) per Criteria #2 then this is substantial product regardless of depth and the characteristics of overlying sediments.*

The following is NOT substantial product:

- *Any layers of non-mobile product (i.e., bands, layers, saturated sediments, stained sediments) that are less than 2 inches thick.*
- *Petroleum odors that are not associated with visual evidence of product beyond sheens and blebs.*
- *Sheens that are not associated with more substantial visuals of product*
- *Isolated product blebs or spots not associated more substantial visuals of product*

Criteria 3 shall consider whether the 5 feet of overlying relatively clean material includes any sediment that would be expected to be removed as part of Army Corps maintenance dredging in the navigation channel. If so, the 5 ft depth requirement should be judged from the depth to which maintenance dredging would occur. The edges of the area with "substantial presence of product" shall be defined by cores which do not contain substantial product. Examples of product containing cores that meet the definition of "substantial product" and examples of cores that do not meet this definition are shown in Figure 3.

The USACE memorandum states that core observations evaluated were collected during completion of the U.S. Moorings Remedial Investigation (RI) in 2008 and a supplemental investigation in 2008/2009. Review of the core locations shown in Figure 1 of the memorandum identified three core stations (i.e., 20-BF, 40-BE, and 50-BG) that were within the EPA-approved Gasco Sediments Site Area of Interest boundary but were not made available to NW Natural during development of the Draft EE/CA. As appropriate, the findings at these stations will be evaluated and incorporated into the Final EE/CA. Figure 1 of the USACE memorandum does not include the locations of a number of core stations that have been collected adjacent to the U.S. Moorings site (i.e., GS-01, SD-4, DGS-36SC, SD-01, DGS-03SC, C527, and C528) by other parties; however, those locations were included in the Draft EE/CA. EPA should evaluate the entire data set when reviewing this sediment area rather than the partial set of information submitted by USACE. NW Natural's review of this information is being provided to help

assure that the definition of substantial product in the Gasco Sediment Site SOW is applied consistently.

First, the USACE's stated assumption that "sediment discoloration," (typically described as "black" or "banded" in RI and supplemental investigation core logs) constitutes "substantial product" is incorrect. The assumption that the presence of sheen/odor is equivalent to the SOW substantial product definition for "stained sediments" is also incorrect. Black colored bands in sediments are present throughout the Lower Willamette River and are often not associated with manufactured gas plant (MGP)-related impacts. The SOW clearly describes that the term "substantial product" is intended to identify product with potential future mobility. To this end, the use of "stained sediments" in the SOW definition should not be interpreted simply as discoloration or banding, but rather sediments that exhibit staining due to saturation with liquid product and are consistent with the other descriptors in the Criteria #1 definition (i.e., bands of product, layers of product, "saturated" sediments, and/or seams of product).

The USACE assumption that all "non-aqueous phase liquid" or "NAPL" on the core logs indicate the presence of substantial product is also incorrect. The SOW clearly states that NAPL observations only meet the definition of substantial product if they are present as a "layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., 'oozes' or 'drips' out of the core during core observations)," and further clarifies that "Isolated product blebs or spots not associated more substantial visuals of product" is not substantial product. The USACE memorandum incorrectly identifies a number of depth intervals in station 43-BB as containing substantial product based on observations of "blebs of brown NAPL," or more simply as "NAPL" in station 50-BG, where the core log does not show seams or layers of liquid that would satisfy the criteria for substantial product identified in the SOW.

NW Natural believes that some of the terminology used in the USACE memorandum core logs clearly indicates a bias for logging observations as MGP-related wastes. For example, a number of core logs use the descriptive terminology "mineralized PAH parting planes" and "PAH enriched sediment." Anchor QEA has never seen these terminologies used during review of other core logs collected in the Lower Willamette River or during investigations at other sites, nor is Anchor QEA familiar with field logging procedures that would allow the specific determination that polycyclic aromatic hydrocarbons (PAHs) are the causes of such visual features in cores. It is also notable that the logs identify odors variously as "PAH odor," "petroleum odor," and "coal tar odor." It is unclear whether there is an observable difference

between PAH and petroleum odor or that any field investigator could reliably distinguish between a generalized petroleum odor and a specific coal tar odor on any consistent basis. Further, the use of the term "coal tar" indicates an expectation of an MGP source on the part of the investigators; however, if the investigators are confident in their olfactory conclusions, then the Gasco plant is certainly not the source of those particular sediment impacts. The Gasco plant used oil, not coal, as a feedstock.

The USACE memorandum misidentifies nine cores as containing substantial product. The misidentification is due to incorrectly applied assumptions coupled with the likely bias in the logging terminology. In fact, in Figure 1 of the USACE memorandum, none of the cores shown adjacent to the U.S. Moorings site achieves the visual criteria described in the SOW. Anchor QEA believes that one core station (50-BG) should be designated as inconclusive for substantial product consistent with the Draft EE/CA terminology. The log for station 50-BG identifies "NAPL" in a number of depth intervals but, as noted previously, there are no clarifying descriptors of seams or layers of liquid of such NAPL, nor are they visually present in the core photos. This station is located within the Gasco Sediment Site cleanup area (referred in the USACE memorandum as the Project Area) upstream of the U.S. Moorings dock. The inconclusive designation will be included in the Final EE/CA but will not affect the substantial product or Interim Project Area boundary.

USACE identifies three potential future maintenance dredge areas (FMDs) in Figure 1: FMD A, B, and C. FMDs B and C were not identified during development of the Portland Harbor Superfund Site draft Feasibility Study (FS) and were not available to NW Natural during development of the Draft EE/CA; therefore, these FMDs were not included in the Draft EE/CA. USACE states that the RI assumed dredge depths of 5 feet below the necessary berthing depths in the FMDs to support placement of a 5-foot cap. NW Natural disagrees with this assumption, particularly since USACE has not documented their cap evaluations or provided a design that requires the use of a 5-foot cap (i.e., capping may be effective with caps less than 5 feet thick). Also, the USACE assumption appears to confuse the 5-foot dredge depth requirement noted in the SOW substantial product criteria with an assumed cap depth, which is a separate issue not immediately relevant to substantial product determination. It should also be noted that the use of 5 feet in Criteria #3 in the SOW is applicable to dredging in the navigation channel, and may not be applicable outside the channel where dredge depths and cap designs could be modified to affect depths less than the assumed 5 feet in the SOW. Regardless, NW Natural's review of the Attachments 1 through 3 of the technical memorandum identifies no substantial product

containing cores in the FMDs, so substantial product will not affect any necessary dredging or capping in these areas.

NW Natural disagrees with the USACE statement that "It should also be assumed that the dock area will need to be dredged to a total depth between -24 and -36 feet Columbia River Datum to remove substantial product, which would require dock removal to prevent reduced structural integrity of the load bearing piles." Given no substantial product is present in the FMDs and that the Remedial Action Levels (RALs) that will determine cleanup areas throughout the Portland Harbor Superfund Site have not yet been selected by EPA, NW Natural disagrees there is a need for any assumption at this point in the process regarding potential dock removal by any party involved in a future cleanup. Further, if cleanup in this area is determined in the future by EPA to be necessary, non-removal technologies such as capping under docks are likely to be highly effective for reasons detailed in the Portland Harbor Superfund Site draft FS. Similarly, NW Natural is not aware of any dock structural evaluations that have been completed to support that dock removal would be necessary following sediment removal to some undefined depth around the dock area followed by immediate cap placement, if necessary.

Lastly, Anchor QEA believes there is a general misunderstanding underlying the USACE memorandum with regards to how the Project Area is determined consistent with the SOW. Specifically, the primary purpose of the SOW substantial product definition is to identify locations and volumes of sediments with a preference for removal. The Project Area, and whether to extend the Project Area in any direction, is determined by multiple lines of evidence consistent with the wider Portland Harbor Superfund Site process as described in the SOW (not just the existence of substantial product).

In an August 9, 2012 letter to NW Natural, EPA states that it considers the Interim Project Area identified in the Draft EE/CA as preliminary. While Anchor QEA agrees that the SOW describes Project Area identification as an iterative process, the SOW clearly describes that these refinements will take place almost entirely prior to the drafting of the EE/CA, including the Section 3.4.1 and 3.4.1.2 SOW quotes provided by EPA in the August 9, 2012 letter. Potential inclusion of U.S. Moorings site sediments in the EE/CA at this late date will require a complete reworking of the document, including significantly different alternatives and evaluation results. Such a decision at this time would mean that the Draft EE/CA was essentially wasted work and would significantly delay the overall Gasco Sediment Site project schedule.

The sediments adjacent to the U.S. Moorings site are included in Sediment Management Area (SMA) 9D in the Portland Harbor Superfund Site draft FS and separate from SMA 9U, which encompasses the Gasco Sediment Site. This separation of SMAs is also consistent with the EPA-approved Final Project Area Identification Report and Data Gaps Quality Assurance Project Plan (QAPP), the Draft EE/CA, and several technical briefings provided to and approved by EPA on the Gasco Sediments Site prior to submittal of the Draft EE/CA. In the Portland Harbor Superfund Site draft FS, the SMA 9D sediments would be actively remediated only under the harbor-wide alternatives with the two lowest PAH RALs. Thus, it has not yet been determined by EPA whether sediments requiring cleanup even exist in SMA 9D.

Any necessary remediation of SMA 9D will be fully addressed by the Portland Harbor Superfund Site process. USACE's sediment observations are typical of sediment observations throughout the Portland Harbor Superfund Site and are not unique to the Gasco Sediments Site. NW Natural is aware of multiple potential contaminant sources in this area, which take into account the long history of ship maintenance and fueling activities at U.S. Moorings itself. Contaminants, such as tributyltin, not associated with Gasco or Siltronic Corporation past uses, have also been well documented in this area. To the extent that cleanup is required in SMA 9D, responsibility for that cleanup is being evaluated in the Portland Harbor Superfund Site process, in which NW Natural, Siltronic, and USACE (i.e., the U.S. government) are participating at EPA's request. The 2009 Consent Order was not intended to address all areas of the Lower Willamette River where contaminants associated with Gasco or Siltronic Corporation operations may have come to be located; indeed, the Consent Order expressly warns that additional remedial action may be required in the harbor-wide Record of Decision (See SOW §3.4.1.1). No information from USACE suggests some urgent need for EPA to prioritize SMA 9D for environmental or public health reasons or to conclude, in advance of the allocation, that NW Natural bears more responsibility than USACE for sediment contamination at this federal facility.

NW Natural hopes that EPA takes this review into consideration to ensure that future sediment evaluations and cleanup at the Gasco Sediment Site accurately identify substantial product consistent with the SOW definition, account for all relevant lines of evidence, and maintain Project Area boundaries and RALs that are consistent with past EPA approvals for the Gasco Sediment Site and EPA's overall approach for the Portland Harbor Superfund Site FS and remedial planning. If you have any questions or concerns, please contact me at (206) 287-9130 or rbarth@anchorqea.com.

Regards,

Ryan Barth, P.E.
Anchor QEA, LLC

cc (via email):

Robert Wyatt, NW Natural
Patty Dost, Pearl Legal Group
Carl Stivers, Anchor QEA
John Edwards, Anchor QEA
John Verduin, Anchor QEA
Kim Slinski, Anchor QEA
Ben Hung, Anchor QEA
Mike Crystal, Sevenson Environmental Services
James Peale, Maul Foster Associates, Inc.
Alan Gladstone, Davis Rothwell Earle & Xóchihua P.C.
Myron Burr, Siltronic Corporation

Attachment D

Reviewed Core Logs

Core Location F

BORING NUMBER	20 BF
PROJECT	US Moorings PRP Study
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
F-SS20-BF-0	0	5		N			**0-10 cm. 7.5YR 3/2. Slightly soft, silty (30%) clay (70%).**
				N	20		Acrid decomposing organics odor.
				N			**10-69 cm. 2.5Y 3/2. Slightly soft, moist, organic (<5%), silty (20-30%) clay (70-80%).**
				N			Cohesive, plastic and slight acrid decomposing organics odor. No sheen visible with
				N	40		application of water. Homogeneous.
				N			
F-SS20-BF-24	58	63		N	60		**69-184 cm. 2.5Y 3/2. Soft, moist, organic (<5%), very clayey (40-50%) silt (50-60%)**
				N			with trace (<1%) very fine sand. Slight organic odor. No sheen could be produced with
				N	80		application of water.
				N			
				N	100		
				N			
				N	120		
				N			
				N	140		
				N			
				N	160		
F-SS20-BF-66	165	170		N			
				N	180		
				N			**184-228 cm. 2.5Y 3/2. Slightly firm, consolidated, moist, organic (<5%), very clayey**
				N	200		**(40-50%) silt (50-60%)** with trace (<1%) very fine sand.
				N			Slight coal tar odor. No sheen could be produced with application of water.
				N	240		**228-374 cm. 2.5Y 3/2. Slightly soft, plastic, moist to damp, organic (<1%)**
				MS			**silty (15-20%) clay (80-85%).**
				MS	260		Slight coal tar odor in upper portion of unit. Black, laminar bands at:
				MS			225-228 cm with moderate to strong coal tar odor
				MS	280		244-245 cm with strong coal tar odor
				MS			267-269 cm strong coal tar odor and blue ropy sheen produced with application of water.
F-SS20-BF-116	292	297		MS	300		288-295 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			315-315.5 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS	320		319-320 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 13 feet
Recovery: 100%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

BORING NUMBER	20 BF
PROJECT	US Moorings PRP Study
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				MS			In black layers, sheen can also be produced in situ with application of pressure on sediment.
				MS			
F-SS20-BF-146	344	349		MS	340		333-341 cm interval is slightly sandy (<10%) and has slight vanillin odor in addition to strong
				MS			coal tar odor.
				MS	360		366-373 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			
					374		**374 cm EOC**

		Notes:
Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Penetration: 13 feet
Coring Method	Vibracore	Acquisition: 13 feet
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Recovery: 100%
Core Collected		
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

Core Location B

BORING NUMBER	43BB
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
B-43-BB-0	0	5		N			**0-99 cm. 2.5 3/1. very silty (40-50%) clay (50-60%)**
				N	20		Soft, moist, organic, plastic, with scattered organic/plant fragments throughout.
				N			Homogeneous. Slight natural organic odor. No sheen could be produced with
				N	40		application of water.
				N			
B-43-BB-24	58	63		N			
				N	60		
				N			
				N	80		
				N			
				N	100		
B-43-BB-40	99	104		SS			**99-112 cm. 2.5Y 3/2. Slightly silty (10-15%) fine sand (85-90%) trace organics (<5%).**
				SS	120		Stiff, damp to dry, in situ sheen at 110.5 cm, moderate coal tar odor ad small (1-2mm) blebs of
				MS			brown NAPL and ropy sheen can be floated out with application of water.
				MS	140		**112-189 cm. 2.5Y 3/1. silty (30-40%) clay (60-70%) with trace (<5%) organics**
				MS			Soft, moist, plastic, with preserved methane vesicles. 1-2 mm lenses of organic particles at
				MS	160		131 and 137 cm. Slight coal tar odor and natural organic odor. 170-179 cm florets of sheen
				MS			can be produced by streaking sediment and sheen can prodiced from this usit with application
				SS	180		of water.
				MS			
				SS	200		**189-214 cm. 2.5Y 3/1. organic (>20% wood), fine sandy (20-30%), silt (50-60%).**
B-43-BB-78	196	201		SS			Soft, moist to wet, wood present as fragments, strong coal tar odor and 1-3 cm streak
				N	220		of in situ dull sheen.
				N			**214-343 cm. Gley 1 10Y 2.5/1. Fine sandy (10-20%) clayey (30-40%) silt (50-60%)**
				N	240		Soft to slightly firm, damp, intercollated sand present as discrete laminar stringers/lenses.
				N			Stringers/lenses of sand at 214-248 cm, 301-302 cm, 309-325 cm. Slight decaying
				N	260		organics odor. No sheen produced with application of water.
				N			
				N	280		
				N			
B-43-BB-116	292	297		N	300		
				N			

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 11.5 feet
Recovery: 88.5%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

BORING NUMBER	43BB (continued)
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION							DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)	STRATA	USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**214-343 cm. Gley 1 10Y 2.5/1. Fine sandy (10-20%) clayey (30-40%) silt (50-60%)**
				N	320		
				N			
				N	340		
				N			**343 cm EOC**
					360		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 11.5 feet
Recovery: 88.5%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

Core Location G

BORING NUMBER	50BG
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
G-5--BG-0	0	5		N			**0-44 cm. 2.5Y 4/2. Slightly silty (15-20%) clay (80-85%).**
				N			Stiff, dry to slightly damp. 10-12 cm band of small (<0.5 cm) organic fragments
				N	20		(root/plant particles). Natural organic odor. No sheen produced with application of water.
				N			
				MS	40		**44-104 cm. Gley 1 2.5/N. Very clayey (40-50%) wood (50-60%).**
				MS			Black, soft, moist. Wood particles are mechanically fragmented and many have a blue coating
G-50-BG-26	66	71		MS	60		that becomes more pronounced with increased time exposed to air. Strong tar odor.
				MS			Minor sheen produced with application of water.
				MS	80		
				MS			
				MS	100		
				MS			**104-427 cm. 2.5Y 2.5/1. Slightly silty (20%) clay (80%).**
				MS			Trace fine sand (<1%). Enitire unit is sompositionally similar in terms of sediment type.
				MS	120		Numerous depositional bands in unit.
				MS			136-136.5 cm. Band of wood/plant fragments with coal tar odor.
				HS	140		140-142.2 cm. Black stained sediment band in laminar orientation. NAPL.
				HS			
				HS	160		161-170 cm, Black, woody, strong coal tar odor.
				HS			
G-50-BG-72	182	188		HS	180		
				HS			191-192. Black stained sediment and mineralized NAPL plane. Very strong coal tar odor.
				HS	200		
				HS			213-227 cm. Black, organic, in-situ sheen and strong coal tar and naphthalene odors.
				HS	220		
				HS			233-240 cm. Very strong naphthalene odor. NAPL and blue sheen with application of water.
				HS	240		240-245 cm. Air pocket/void.
G-50-BG-98	249	254		HS			245-256 cm. Strong to overwhelming naphthalene odor. In-situ sheen with pressure.
				HS	260		256-261 cm. In-situ sheen, mineralized NAPL bands, very strong naphthalene odor. NAPL.
				HS			261-290 cm. 2.5Y 3/2. Moist. Very strong coal tar and naphthalene odor.
				HS	280		
G-50-BG-116	295	300		HS			290-299 cm. Black, dense in situ sheen. Very strong coal tar odor.
				HS	300		299-315 cm. 2.5Y 3/2. Moist. Very strong coal tar and naphthalene odor.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes:
Coring Method	Vibracore	Penetration:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Acquisition:
Core Collected	19-April-2008	Recovery:
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

BORING NUMBER	50 BG
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				HS			
				HS	320		315-317 cm. Black, strong in situ sheen and NAPL. Very strong coal tar and naphthalene odor.
				HS			317-350 cm. 2.5Y 3/2. Silty (20%) clay (80%) with strong coal tar odor.
				HS	340		slightly soft, plastic.
				HS			
				HS	360		350-352 cm. Black, in-situ sheen, NAPL, very strong coal tar odor.
				HS			352-367 cm. In-situ sheen and very strong coal tar odor.
G-50-BG-146	370	376		HS	380		367-374 cm. Black, in situ sheen. Strong coal tar odor.
				HS			380 cm. Plane of mineralized NAPL.
				MS	400		390-391 cm. Laminar black band with in-situ sheen and very strong coal tar odor.
				MS			391-427 cm. Slightly soft, plastic, damp to moist silty (15-20%) clay (80-85%). Moderate
				MS	420		coal tar odor.
							427 cm EOC
					440		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes:
Coring Method	Vibracore	Penetration:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Acquisition:
Core Collected		Recovery:
COORDINATES		
SURFACE ELEVATION		Cores archived frozen since collection and thawed prior to Processing
DATUM		Core not expanded based on compaction during processing

Core Location D2

BORING NUMBER	53BD
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
D2-53-BD-0	0	5		N			**0-20 cm. 2.5Y 3/3. Silty (40%) clay (60%).**
				N			Dry, soft, natural organic odor. Texture has been modified by freezing/thaw.
				N	20		**20-363 cm. 5Y 2.5/1. Trace sandy (<5%), silty (30-40%) clay (55-70%).**
				N			Bulk unit, soft, cohesive, slightly plastic. Moist. Multiple substrata
				N	40		
D2-53-BD-24	61	66		N			58 cm. Vesiculated slag with PAH odor. No sheen produced with application of water.
				N	60		
				N			71 cm. Coal tar odor, no sheen produced with application of water.
				N	80		
				N			
				Y	100		
				Y			
				N	120		125 cm. 1 mm stringer of sand, coal tar odor.
				N			
				N	140		
				N			
				N	160		
				N			
				N	180		
				N			183 cm. Laminar stringer/parting plane of very fine sand.
				N			195-199 cm. Silty (30%) fine sand (70%) with distinct coal tar odor.
D2-53-BD-83	211	216		SS	200		205-212 cm. Loose, wet layr of wood and plant particles. Strong coal tar odor. Sheen can
				N			be produced as ribbons with application of water.
				N	220		
				N			
				N	240		
				N			
				N	260		
				N			
				N	280		
				N			
				SS	300		295 cm. Laminar band of black sediment with stron coal tar odor. Sheen produced with
D2-53-BD-118	300	305		SS			application of water.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration:
Acquisition:
Recovery:

Cores archived frozen since collection and thawed prior to Processing

Core not expanded based on compaction during processing

BORING NUMBER	53BD
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION							DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)	STRATA	USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**20-363 cm. 5Y 2.5/1. Trace sandy (<5%), silty (30-40%) clay (55-70%).**
				N	320		
				N			
				N	340		
				N			357-363 cm. Black stained band of sediment with strong coal tar odor and sheen can
D2-53-BD-143	363	368		HS	360		be produced in-situ with application of pressure.
							363 cm EOC
					380		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes: Penetration:
Coring Method	Vibracore	Acquisition:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Recovery:
Core Collected		
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

BORING NUMBER	SDDA-18 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N	12		Wet, unconsolidated silty clay (30/70) with scattered very minor fine sand. Petroleum odor.
				SS			**10-10.75"**
				SS	24		Black band of poorly graded sandy silt (40/60) with strong petroleum odor and sheen.
				SS			Mineralized parting plane
				SS	36		**10.75-48" SILTY CLAY (ML)**
				SS			Soft, brownish olive-gray, methanogenic, mosit silty/clay (30/70) with thin (<1") sand stringers.
				SS	48		Bands of black sediment throughout unit and banded sediment has stong PAH oder. Bands
				SS			are 0.1-0.2 " thick and are at 24",26",30",31",38",41",43",44" below mudline.
				SS	60		**48-90" SILTY CLAY (ML)**
				SS			Soft, slightly cohesive silty clay that is moist and methanogenic. Varies from brown to black.
				SS	72		Interbedded stringers of silt and sorted very fine sand 58-59", 61.5", 71", 76" and 82".
				SS			Stringers are 0.25" thick at maximum. Bands of black sediment that has strong PAH odor and
				SS	84		sheen at 53-56", 63", 64", 75", 77",81"92" and 96". Mineralized PAH parting plane in 63" band.
				SS			
				SS	96		
				SS			**96-109" SILTY CLAY (ML)**
				SS	108		Soft, moist, cohesive, plastic, silty clay (30/70) with black band having mineralized PAH parting
				N			planes at 102" and 107".
				N	120		**109-138" SAND (SW)**
				N			Soft, damp, well-sorted, uniformly graded, gray fine sand with clasts of silty clay.
				N	132		No odor, no sheen.
				N			
					144		**138-144"- Not logged. Retained intact for geotech sample.**
				N			**144-167" SAND (SW)**
				N	156		Soft, damp, well-sorted, uniformly graded, gray fine sand with clasts of silty clay.
				N			No odor, no sheen.
				N	168		**167-174 Peat (Pt)**
				N			Peaty, oganic silt with laminar wood, root and plant fragments. Compact, wet.
				N	180		**174-197" SAND (SW)**
				N			Firm, well-sorted, uniformly graded fine sand with rip-up clasts of cohesive brown clay.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	20-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 19 ft
Acquisition: 16.8 ft
Recovery: 88%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDA-19 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-20" SILTY CLAY (ML)**
				N	12		Unconsolidated. Wet, homogeneous, very silghtly sandy, clayey silt (5/30-35/60-70)
				N			becoming slightly more consolidated with depth.
				N	24		**20-29" SILTY CLAY (ML)**
				N			Soft, wet, highly organic, silty clay with >20% wood by volume and PAH odor.
				N	36		**20-48" SILTY CLAY (ML)**
				N			Intercollated, slightly fine sandy silt and clay. 0.5 to 0.75 bands of black clay with moderate to
				N	48		strong PAH odor at 38", 42: and 46". Stringer of fine sand at 48".
				SS			**48-100" SILTY CLAY (ML)**
				SS	60		Cohesive, silty clay (30/70) with occasional thin stringers of very fine sand. Silty clays are
				SS			banded with black bands with strong coal tar ofor and slight sheening. Bands are at
				SS	72		50", 56", 59", 63.5 ", 67",71", 76", with mineralized PAH parting planes within the 63.5" and
				SS			71" bands. Three hard, 0.25 " dia. cohesive clay clasts at 78". Number of fine sand
				SS	84		stringers increases between 84-90"
				SS			
					96		90-96" Not logged. Retained intact for geotech sample.
							100-128" SAND (SM)
					108		Firm, moist, dark brown, silty fine sand (30/70) with very minor clay subcomponen that is
							present in intercollated lenses. No odor, no sheen.
					120		**128-140 SAND (SW)**
							Firm, damp, well-sorted, uniformaly graded, very fine sand. No odor, no sheen.
					132		
							EOC
					144		
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 15 ft
Acquisition: 12 ft
Recovery: 80%

Core expanded based on compaction during processing
Material in core catcher discarded.

Enclosure

BORING NUMBER	SDDB-20
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, olive-brown silty clay. Unconsolidated and almost fluid. Methane vesicles and no
				N	12		odor.
				N			
				N	24		
				N			
				N			**10-74" SILTY CLAY (ML)**
				N	36		Very soft, olive brown, silty clay (30/70) with methane vesicles and small organic/plant
				N			fragments scattered throughout. Slightly plastic in upper portion and grades to plastic at
				N	48		**46"-74".SILTY CLAY (ML)**
				N			
				N	60		
				N			
				N			**74-82" SILTY CLAY (ML)**
				N	72		Black to brown, soft, cohesive, pastic, silty clay with PAH odor. Black band at 74"-75".
				SS			
				SS	84		
							90-96" Not logged. Retained intact for geotech sample.
					96		
				SS			**82"-144" SILTY CLAY (ML)**
				SS	108		Banded, cohesive, silty clay with black bands that have diffuse sheen and stron PAH odor at
				SS			99-102", 11", 112", 118", 119", 120", 125", 128", 129-130". Bands are thin (<0.5") unless
				SS	120		noted as a range.
				SS			
					132		**133-140" Gap in sample**
				N			**140-153" SILTY CLAY (ML)**
				N	144		Cohesive, interbedded, fine sandy silt and clay.
					156		**EOC**
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 13:30
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 ft
Acquisition: 13 ft
Recovery: 100%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDC-23
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	23-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, unconsolidated, slightly silty clay (20/80).. No odor.. Wood and plant fragments.
				N	12		**10"-22" SILTY CLAY (ML)**
				N			Soft, wet, silt with methane vesicles and slight PAH odor.
				N	24		**22-48" SILTY CLAY (ML)**
				N			Soft, organic silt with methane vesicles and scattered small (<0.5") plant fragments.
				N	36		Black bands at 30-32" that have no odor.
				N			
				N	48		**48-120" SILTY CLAY (ML)**
				N			Soft, slightly plastic, organic silty clay (30/70) with methane vesicles and homogenous
				N	60		texture. Occasional thin (<0.25") laminar bands of oprganics (plant fragments)
				N			
				Y	72		72-84" Black organic inclusion that contain wood fragments and have PAH odor.
				N			
				N	84		
				N			
				N	96		100" cored through wood fragment
				N			
				Y	108		
				Y			108-120 Sediment becomes darker, sheening occurs and strong PAH odor.
				Y	120		**120-144" SILTY CLAY (ML)**
				Y			Banded black and brown silty clay (30/70) with laminar lenses of wood particles. Very strong
				Y	132		PAH/coal tar odor. No free NAPL but widespread irresescent sheen in 0.1-0.25 florets.
					144		
				Y			**144-150 Retained intact for geotech sample**
				Y			**150-180" SILTY CLAY (ML)**
				Y	156		Firm, moist, plastic, organic silty clay (30/70) with laminar black bands at 153-156",
				Y			162", 163". Each band 0.2" thick and has strong sheening and strong to overwheming
				Y	168		PAH/Coal tar odor. 171-180" thick band of black, PAH enriched sediment with strong odor.
				Y			**180-192" SILTY CLAY (ML)**
					180		Hard, intercollated blAck to brown silty clay with laminar bands oF organics/wood/plant. **EOC**.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	20-April-2008 10:24
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 19 ft
Acquisition: 16.4 ft
Recovery: 86%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDC-24
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	21-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, unconsolidated, slightly silty clay (30/70) with slight natural organic odor.
				N	12		**10"-60" SILTY CLAY (ML)**
				N			Soft, moist to wet, organic, silty clay (30/70) with methane vesicles and becomes slightly
				N	24		firmer with increasing depth.
				N			
				N	36		
				N			
				N			
				N	48		
				N			
				N			
				N	60		
				N			**60-126" SILTY CLAY (ML)**
				N			Layered silty clay (30/70) with black banding at 76" that has strong coal tar odor.
				SS	72		
				SS			
				SS			
				SS	84		
				SS			Wood lens.
				MS	96		**96-114" SILTY CLAY (ML)**
				MS			Loose, wet, black, woody silt with H2S and Coal tar odors. Strong. Sheen in abundant 0.2 "
				MS	108		florets.
							114-120" - Not logged. Retained intact for geotech sample
					120		
				MS			124" Void in core that extended into geotech sample.
				MS			**126-144" SILTY CLAY (ML)**
				MS	132		Laminated, black, organic silty clay with wood fragments, sheen and strong PAH odor.
				MS			Several laminar bands have mineralized PAH parting planes.
					144		**EOC**
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 14:12
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 15 ft
Acquisition: 13 ft
Recovery: 87%

Core expanded based on compaction during processing
Material in core catcher discarded.

Core Location E

BORING NUMBER	40BE
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
E-40-BE-0	0	5		N			**0-8 cm. 7.5 YR 2/2. Dry, soft, organic (<5%) silty (30-40%) clay (60-70%).**
				N			Acrid decomposing organics odor. No sheen could be produced with application of water.
				N	20		**8-32 cm. 2.5Y 3/1. Slightly soft, damp, plastic, silty (30%) clay (70%).**
				N			Two small brick fragments at 18 cm. Organic odor. No sheen could be produced with water.
				N	40		**32-107 cm. 7.5YR 2.5/2. Loose, wet, soft, organic, very silty (40%) clay (60%).**
E-40-BE-24	58	63		N			Non-plastic, dilatent, White concrete-like sands mixed in at 70-75 cm interval and in that interval
				N	60		constitute 20% of sediment. Slight acrid organic odor. No sheen could be produced with
				N			application of water.
				N	80		
				N			
				N			
				MS	100		**109-139 cm. 2.5Y 3/1. Very soft, wet to moist, very silty (40-50%) clay (50-60%).**
				MS			Strong coal tar odor. Blue strings of sheen produced with application of water.
				MS	120		
E-40-BE-52	130	135		MS			
				MS	140		**139-193 cm. 2.5Y 3/2. Well-sorted, fine to medium sand (95%) and trace silt (5%)**
				MS			with 5-10 cm clasts of clay. Clay clasts have strong coal tar odor and ropy blue sheen can .
				MS	160		be produced with application of water. From 169 to 193 cm, mixed silt/clay fraction
				MS			increases to 20-30%
				MS	180		
				N			**193-272 cm. 2.5Y 3/2. soft, damp, fine sand (>95%) with very trace silt/clay (<5%).**
				N	200		Well-sorted, evenly graded, homogenous. No sheen could be produced with application of
				N			water.
				N	220		
				N			
				N	240		
				N			
				N	260		
				N			**272-305 cm. 2.5Y 3/2. Well-sorted medium sand**
E-40-BE-106	267	272		N			with rip-up clasts of dense, cohesive silty clay. No odor. No sheen could be produced with
				N	280		application of water.
				N			
				N	300		**305 cm EOC**

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 12.7 feet
Recovery: 82.3%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C263

Collection Date:	09/30/2004	**Logged By:**	S.FitzGerald/J.Moore
Core Processing Date:	10/01/2004	**Mudline Elevation (NAVD88 ft):**	1.84
Core Tube Length (ft):	14	**Easting:**	7623183.11
Core Drive Length (ft):	13	**Northing:**	706139.58
Core Recovered Length (ft):	12.3	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

integral consulting inc

LWG LOWER WILLAMETTE GROUP

Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
0		SILT: wet; brown to gray; strong TPH odor; sheen; tr small wood frags	0/0/100 0/5/95	LW2-C263-A (archived)	25	59
-30 (-1)		SILT: silt w/tr fine sand; gray to brown; strong TPH odor; sheen, <1cm laminations of black stained silt every 4cm; tr wood frags	0/<25/>75	LW2-C263-B (ANALYZED)	280	46
-60 (-2)		SILT w/sand: silt w/few med sand; medium plasticity; brown to light brown; strong TPH odor; sheen, black stained silt w/few med grained sand @ 47-51cm	0/<25/>75			
-90 (-3)		SILT w/sand: silt w/few med sand; medium plasticity; black; strong TPH odor; sheen; some plant frags and wood frags	0/<5/100			
-120 (-4)		SILT: silt w/tr fine sand; medium plasticity; gray; strong TPH odor; sheen, <0.5 cm laminations of black stained silt every 2-3cm				
-150 (-5)		SILT: silt w/tr fine sand; medium plasticity; gray; strong TPH odor; strong TPH odor and sheen, black stained silt @ 170-180cm, 226-242cm and 266-276cm; tr plant frags	0/<5/100	LW2-C263-C (archived)	250	63
-270 (-9)						
-280 (-9)		SILT: as above; medium plasticity; gray; strong TPH odor; sheen, w/stained lenses at 303-314cm, 328-334cm, and 364-370cm; tr plant frags	0/<5/100	LW2-C263-D (ANALYZED)	522	44
-370 (-12)						

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C263

Collection Date:	09/30/2004	**Logged By:**	S.FitzGerald/J.Moore
Core Processing Date:	10/01/2004	**Mudline Elevation (NAVD88 ft):**	1.84
Core Tube Length (ft):	14	**Easting:**	7623183.11
Core Drive Length (ft):	13	**Northing:**	706139.58
Core Recovered Length (ft):	12.3	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
1						

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C527

Collection Date:	10/25/2005	**Logged By:**	Susan Fitzgerald
Core Processing Date:	10/26/2005	**Mudline Elevation (NAVD88 ft):**	-4.00
Core Tube Length (ft):	20.0	**Easting:**	7623022
Core Drive Length (ft):	19.0	**Northing:**	706136
Core Recovered Length (ft):	15.8	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

integral consulting inc.

LWG Lower Willamette Group

Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)		Sample ID	FID (ppm)	PID (ppm)
0 / 0		SILT w/sand: silt w/v.fine-fine sand, 5-10% meth.ves.; soft; med grayish brown; mild odor; tr rootlets	0/25/75	ANALYZE	LW2-C527-A	110	34
-30 / -1		SILT w/sand: silt w/tr v.fine sand, w/tr fine sand in lenses, sand in matrix decreases below ~60cm, tr meth.ves.; stiff; med grayish brown; mild sulfur odor; tr faint blk stain in fine-sand lenses starting @ 45cm; tr rootlets, blk organic lens from 69-71cm	0/90/10	ANALYZE	LW2-C527-B	352	42
-150 / -5		SILT w/sand: silt w/tr v.fine sand as above, w/tr fine-med sand in lenses and laminae (2-4mm thick), tr isolated gravel (fine, 0.5cm, subangular) @205cm; stiff; mild-mod tarry odor; faint blk stain in bands on silt, heavier stain on most sand laminae	<5/90/10	ANALYZE	LW2-C527-C	372	48
-250 / -8		SILT w/sand: silt w/tr v.fine sand, w/v.fine-fine sand in laminae and organic beds; mod-strong TPH odor; blk staining, heavy sheen; ~25% organic laminae and beds (woody detritus, plant debris, rootlets); staining typ. assoc. w/organic deposits, the heavy sheen is on organic bed @ 405-407cm	0/25/75	archive	LW2-C527-D	347	59
-350 / -11					LW2-C527-E	183	84

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C527

Collection Date:	10/25/2005	**Logged By:**	Susan Fitzgerald
Core Processing Date:	10/26/2005	**Mudline Elevation (NAVD88 ft):**	-4.00
Core Tube Length (ft):	20.0	**Easting:**	7623022
Core Drive Length (ft):	19.0	**Northing:**	706136
Core Recovered Length (ft):	15.8	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

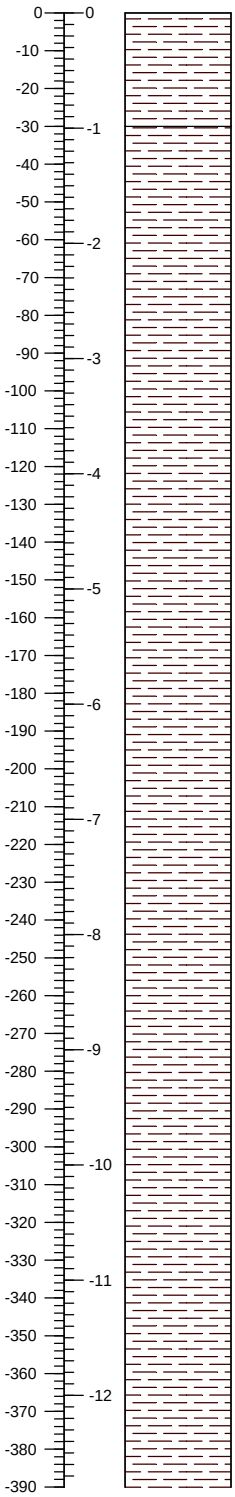
Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
-390						
-400	-13					
-410						
-420						
-430	-14					
-440						
-450						
-460	-15					
-470						
-480						

ANALYZE

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C528

Collection Date:	10/25/2005	**Logged By:**	Susan Fitzgerald
Core Processing Date:	10/26/2005	**Mudline Elevation (NAVD88 ft):**	-8.00
Core Tube Length (ft):	20.0	**Easting:**	7622856
Core Drive Length (ft):	19.0	**Northing:**	706193
Core Recovered Length (ft):	16.1	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet



Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
		SILT: silt w/tr v.fine sand, tr meth.ves.; soft; med grayish brown; mild sulfur odor; tr plant debris	0/<5/100	ANALYZE LW2-C528-A	146	28+
		SILT: silt w/tr v.fine sand as above, tr fine sand in lenses & laminae (1-3 mm thick) @155cm & in laminae & beds (up to 10 cm thick) below 398cm, tr meth.ves.; stiff-v.stiff; med grayish brown; tarry odor; blk stain in bands up to 14cm thick starting @ 154cm, sheen on some bands; tr rootlets; tr debris (4cm diam. pipe segment @ 345cm, metal debris @ 397cm), abrupt basal contact	0/<5/100	ANALYZE LW2-C528-B	310	24+
				ANALYZE LW2-C528-C	312	15
				ANALYZE LW2-C528-D	274	25+
				archive LW2-C528-E	31	28

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C528

Collection Date:	10/25/2005	**Logged By:**	Susan Fitzgerald
Core Processing Date:	10/26/2005	**Mudline Elevation (NAVD88 ft):**	-8.00
Core Tube Length (ft):	20.0	**Easting:**	7622856
Core Drive Length (ft):	19.0	**Northing:**	706193
Core Recovered Length (ft):	16.1	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
-390						
-400 -13						
-410						
-420						
-430 -14						
-440						
-450		SAND: fine sand, well sorted, w/tr silt lenses (1-3mm thick); dense; dk brownish gray; mild sulfur odor	0/100/<5	archive / ANALYZE LW2-C528-F	8	15
-460 -15						
-470						
-480						
-490 -16						

SUBSURFACE SEDIMENT CORE PROCESSING LOG

PROJECT NAME	**Gasco AIR Data Gaps Sampling**	STATION ID	**DGS-03**
JOB NUMBER	**000029-02.28**	DATE/TIME	**10/5/10 / 16:00**
DRIVE LENGTH (ft)	**20**	CORE LOGGED BY	**JMD, NS**
RECOVERY (ft)	**15.4**	CORED BY	**MSS**
PERCENT RECOVERY	**77%**	ATTEMPT NO.	**1**
RECOVERY TO PROCESS (ft)	**15.3**	REFUSAL ENCOUNTERED	**No**
X COORDINATE	**7623175.82**	DIAMETER/TYPE OF CORE	**4" / Vibracore**
Y COORDINATE	**706212.73**	MUDLINE ELEVATION (ft)	**-24.6**
HORIZONTAL DATUM	**Oregon State Plane, NAD83, Int. ft.**	VERTICAL DATUM	**NAVD88**

LITHO-LOGIC COLUMN	CLASSIFICATION AND REMARKS (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	DEPTH IN FEET	SUBSTANTIAL PRODUCT PRESENT (Y/N)	SAMPLE (Bulk Chemistry)	SAMPLE (TCLP, DRET)	SAMPLE (SBLT, Other)
	0 to 5.4 feet: wet, soft, silty fine SAND. No odor or sheen, density increases with depth to 5.4 feet.	1 2 3 4 5	N	DGS-03-0001 DGS-03-0104 DGS-03-0408 DGS-53-0408 (FD)		

REMARKS

Logging and sample depth were not corrected for percent recovery.

ANCHOR QEA

GASCO7.gds:6.1/19/11...GASCO7

SUBSURFACE SEDIMENT CORE PROCESSING LOG

PROJECT NAME	**Gasco AIR Data Gaps Sampling**	STATION ID	**DGS-03**
JOB NUMBER	**000029-02.28**	DATE/TIME	**10/5/10 / 16:00**
DRIVE LENGTH (ft)	**20**	CORE LOGGED BY	**JMD, NS**
RECOVERY (ft)	**15.4**	CORED BY	**MSS**
PERCENT RECOVERY	**77%**	ATTEMPT NO.	**1**
RECOVERY TO PROCESS (ft)	**15.3**	REFUSAL ENCOUNTERED	**No**
X COORDINATE	**7623175.82**	DIAMETER/TYPE OF CORE	**4" / Vibracore**
Y COORDINATE	**706212.73**	MUDLINE ELEVATION (ft)	**-24.6**
HORIZONTAL DATUM	**Oregon State Plane, NAD83, Int. ft.**	VERTICAL DATUM	**NAVD88**

LITHO-LOGIC COLUMN	CLASSIFICATION AND REMARKS (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	DEPTH IN FEET	SUBSTANTIAL PRODUCT PRESENT (Y/N)	SAMPLE (Bulk Chemistry)	SAMPLE (TCLP, DRET)	SAMPLE (SBLT, Other)
	Same as above.					
	5.4 to 10.5 feet: damp, medium, stiff, fine SAND with trace silt, slight hydrocarbon-like odor, no sheen.	6	N	DGS-03-0408 (cont.) and DGS-53-0408 (FD)		
		7				
		8				
		9		DGS-03-0812		
		10				

REMARKS

Logging and sample depth were not corrected for percent recovery.

ANCHOR QEA

SUBSURFACE SEDIMENT CORE PROCESSING LOG

PROJECT NAME	**Gasco AIR Data Gaps Sampling**	STATION ID	**DGS-03**
JOB NUMBER	**000029-02.28**	DATE/TIME	**10/5/10 / 16:00**
DRIVE LENGTH (ft)	**20**	CORE LOGGED BY	**JMD, NS**
RECOVERY (ft)	**15.4**	CORED BY	**MSS**
PERCENT RECOVERY	**77%**	ATTEMPT NO.	**1**
RECOVERY TO PROCESS (ft)	**15.3**	REFUSAL ENCOUNTERED	**No**
X COORDINATE	**7623175.82**	DIAMETER/TYPE OF CORE	**4" / Vibracore**
Y COORDINATE	**706212.73**	MUDLINE ELEVATION (ft)	**-24.6**
HORIZONTAL DATUM	**Oregon State Plane, NAD83, Int. ft.**	VERTICAL DATUM	**NAVD88**

LITHO-LOGIC COLUMN	CLASSIFICATION AND REMARKS (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	DEPTH IN FEET	SUBSTANTIAL PRODUCT PRESENT (Y/N)	SAMPLE (Bulk Chemistry)	SAMPLE (TCLP, DRET)	SAMPLE (SBLT, Other)
	Same as above.					
	10.5 to 10.9 feet: damp, medium, stiff SILT, no odor or sheen.					
	Same as 5.4 feet.	11	N	DGS-03-0812 (cont.)		
	Same as 10.5 feet.	12				
	Same as 5.4 feet but no odor.	13		DGS-03-1215.3 MS/MSD Requested		
		14				
		15				

REMARKS

Logging and sample depth were not corrected for percent recovery.

ANCHOR QEA

SUBSURFACE SEDIMENT CORE PROCESSING LOG

PROJECT NAME	**Gasco AIR Data Gaps Sampling**	STATION ID	**DGS-03**
JOB NUMBER	**000029-02.28**	DATE/TIME	**10/5/10 / 16:00**
DRIVE LENGTH (ft)	**20**	CORE LOGGED BY	**JMD, NS**
RECOVERY (ft)	**15.4**	CORED BY	**MSS**
PERCENT RECOVERY	**77%**	ATTEMPT NO.	**1**
RECOVERY TO PROCESS (ft)	**15.3**	REFUSAL ENCOUNTERED	**No**
X COORDINATE	**7623175.82**	DIAMETER/TYPE OF CORE	**4" / Vibracore**
Y COORDINATE	**706212.73**	MUDLINE ELEVATION (ft)	**-24.6**
HORIZONTAL DATUM	**Oregon State Plane, NAD83, Int. ft.**	VERTICAL DATUM	**NAVD88**

LITHO-LOGIC COLUMN	CLASSIFICATION AND REMARKS (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	DEPTH IN FEET	SUBSTANTIAL PRODUCT PRESENT (Y/N)	SAMPLE (Bulk Chemistry)	SAMPLE (TCLP, DRET)	SAMPLE (SBLT, Other)
	Same as above.		N	DGS-03-1215.3 (cont.)		
	End of core at 15.3 feet.	16 17 18 19 20				

REMARKS

Logging and sample depth were not corrected for percent recovery.

ANCHOR QEA

SUBSURFACE SEDIMENT CORE PROCESSING LOG

PROJECT NAME	**Gasco AIR Data Gaps Sampling**	STATION ID	**DGS-36**
JOB NUMBER	**000029-02.28**	DATE/TIME	**10/12/10 / 11:30**
DRIVE LENGTH (ft)	**13.2**	CORE LOGGED BY	**JMD, NS**
RECOVERY (ft)	**10.8**	CORED BY	**MSS**
PERCENT RECOVERY	**82%**	ATTEMPT NO.	**1**
RECOVERY TO PROCESS (ft)	**10**	REFUSAL ENCOUNTERED	**Yes**
X COORDINATE	**7623112.48**	DIAMETER/TYPE OF CORE	**4" / Vibracore**
Y COORDINATE	**706100.03**	MUDLINE ELEVATION (ft)	**-4.7**
HORIZONTAL DATUM	**Oregon State Plane, NAD83, Int. ft.**	VERTICAL DATUM	**NAVD88**

LITHO-LOGIC COLUMN	CLASSIFICATION AND REMARKS (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	DEPTH IN FEET	SUBSTANTIAL PRODUCT PRESENT (Y/N)	SAMPLE (Bulk Chemistry)	SAMPLE (TCLP, DRET)	SAMPLE (SBLT, Other)
	0 to 4.1 feet: moist, brown/black, soft, sandy SILT, moderate hydrocarbon-like odor.			DGS-36-0001		
	@ 0.7 feet: 2 cm black band.	1				
	@ 1.2 feet: floret of metallic sheen.		N			
		2				
	@ 2.3 feet: metallic sheen bleb (<2 inches).					
		3				
				DGS-36-0104		
		4				
	4.1 to 4.5 feet: damp, dark gray, medium dense, fine SAND with trace silt, hydrocarbon-like odor.			DGS-36-0408		
	4.5 to 10.0 feet: same as 0.0 with substantial fine sand.	5				

REMARKS

Logging and sample depth were not corrected for percent recovery.

ANCHOR QEA

SUBSURFACE SEDIMENT CORE PROCESSING LOG

PROJECT NAME	**Gasco AIR Data Gaps Sampling**	STATION ID	**DGS-36**
JOB NUMBER	**000029-02.28**	DATE/TIME	**10/12/10 / 11:30**
DRIVE LENGTH (ft)	**13.2**	CORE LOGGED BY	**JMD, NS**
RECOVERY (ft)	**10.8**	CORED BY	**MSS**
PERCENT RECOVERY	**82%**	ATTEMPT NO.	**1**
RECOVERY TO PROCESS (ft)	**10**	REFUSAL ENCOUNTERED	**Yes**
X COORDINATE	**7623112.48**	DIAMETER/TYPE OF CORE	**4" / Vibracore**
Y COORDINATE	**706100.03**	MUDLINE ELEVATION (ft)	**-4.7**
HORIZONTAL DATUM	**Oregon State Plane, NAD83, Int. ft.**	VERTICAL DATUM	**NAVD88**

LITHO-LOGIC COLUMN	CLASSIFICATION AND REMARKS (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	DEPTH IN FEET	SUBSTANTIAL PRODUCT PRESENT (Y/N)	SAMPLE (Bulk Chemistry)	SAMPLE (TCLP, DRET)	SAMPLE (SBLT, Other)
	Same as above.			DGS-36-0408 (cont.)		
	@ 6.0 to 6.7 feet: slight metallic sheen that doesn't penetrate through depth of core.	6	N			DGS-36-066.7
	@ 6.7 to 6.8 feet: decomposed layer of wood.	7				
		8				
		9		DGS-36-0810		
	End of core at 10.0 feet.	10				

REMARKS

Logging and sample depth were not corrected for percent recovery.

ANCHOR QEA

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**1 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
GS-01-W(4-6)[1] GS-01-S(4-6)[2]	16.5 (0-23)	5	X	X				**0 to 23.0 feet: INTERBEDDED SILT (ML); SANDY SILT (ML); SILTY SAND (SM), AND SAND (SP)**; grayish-brown; loose sand; soft to firm silt; trace fine subrounded gravel; wet. Black staining 0 to 2.0 feet. Hydrocarbon-like odor. Odor decreasing with depth. Gravel decreasing with depth.
GS-01-W(9-11)[1] GS-01-S(9-11)[2] GS-01-S(10-12)[3]		10	X	X	X			
		15						
		20						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**2 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
GS-01-S(20-23)[2]								**0 to 23.0 feet: INTERBEDDED SILT (ML); SANDY SILT (ML); SILTY SAND (SM); AND SAND (SP)**, continued.
GS-01-S(20-23)[3]								
GS-01-W(23-27)[1]								**23.0 to 28.5 feet: INTERBEDDED SANDY SILT (ML) and SILT (ML)**; grayish-brown; soft to firm; wet. Sand lenses up to 1 inch.
		25						
								28.5 to 34.0 feet: SAND (SP); grayish brown; 95 to 100 percent fine to medium sand; trace to 5 percent fines; loose to medium density; wet. Silt lenses.
		30						
GS-01-S(30.5-33)[3]	24 (23-48)							
		35						**34.0 to 35.5 feet: INTERBEDDED SAND (SP)**; grayish-brown; 95 to 100 percent fine to medium sand; wet; **AND SAND WITH SILT (SP)**; grayish-brown; 85 to 95 percent fine to medium sand; 5 to 15 percent fines; loose; wet. Trace fine, subrounded gravel and cobbles.
								35.5 to 40.0 feet: INTERBEDDED SANDY SILT (ML) AND SILT (ML); grayish-brown; soft to firm; wet. Sand lenses up to 4 inches.
		40						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**3 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
GS-01-S(40-42.5)[3]								**40.0 to 48.0 feet: SAND (SP)**; grayish-brown; 95 to 100 percent fine to medium sand; trace to 5 percent fines; loose to medium density; wet. Silt lenses up to 1 inch.
GS-01-S(45-48)[2]		45						
GS-01-W(48-52)[1]								**48.0 to 77.0 feet: SAND (SP)**; grayish-brown; 100 percent fine to medium sand; trace fines and coarse sand; loose to medium density; wet. Increasing density with depth.
GS-01-S(50-52)[3]		50						
	24.5 (48-73)							
		55						
GS-01-S(59-61.5)[3]								
		60						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**4 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
		65						**48.0 to 77.0 feet: SAND (SP)**, continued.
GS-01-S(70.5-73)[3]		70						@ 69.5 to 71.5 feet: silt lenses up to 2-inches thick.
GS-01-W(73-77)[1]	11.5 (73-80)	75						**77.0 to 80.0 feet: INTERBEDDED BASALT; GRAVELLY SILT (ML)**; gray; 50 to 60 percent low to medium plasticity fines; 40 to 50 percent fine to coarse, angular to subrounded gravel; firm to stiff; damp to moist; **AND SILTY GRAVEL (GP)**; gray; 50 to 60 percent fine to coarse, angular to subrounded gravel; 40 to 50 percent
		80						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**5 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
		85						low to medium plasticity fines; medium to density to dense; damp to moist.
		90						Bottom of boring = 80.0 feet.
		95						
		100						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

CONTENTS

PAGE	REFERENCE	DATE

US Moorings 9/10/02

1

- Sunny & Clear

0700 - Arrive at US Moorings Facility - Check in at front office.
Chris Moody, Ron Feldstein, Bruce Titus

0715 - Meet John V. @ Dock & Proceed to Load
Decon Core & Liners. Bowls/spoons Pre-cleaned.

0818 - Move Boat to SD-01 Location.
- will need two runs Per location

0825 - @ SD-001, Prepare Core & Retrieve
1st Run 2' Recovery

Description of Core
- Sandy Clay - No Vegetation
Fairly Homoginized
no debris, no oil sheen, no organic odor
Sand is V. fine with silt & Clay (CH)
Color is Black Gley - 1 2.5/N
Sands are Micapus
- 2nd Run recovery = 28"
Core on 2nd run generally the Same with the following differences:
- Organic odor & sheen associated with layers of Woody debris
thickness of woody debris is 1"-2"
Color for 2nd Run ranges from V. Dark grey to Black

9/10/02

will need 3rd Core at SD-001 to allow for enough sample volume.

Decontamination Procedure / Sampling Procedure

- As Core is retrieved from the bottom, it is washed down using river water supplied from a hose + sprayer on the boat. After the outside of the Core barrel is washed down, the Core is retrieved from inside the barrel by removing the shoe of the Core, then the catcher. The Core is then measured for recovery, visual observations are noted thru the Clear Core liner + the Core is extruded into a Clear Stainless Steel bowl.

Prior to extrusion, any overlying river water is slowly decanted to minimize the loss of fines. (occurred at all Sample Stations)

0958 - retrieve 3rd run. 32" of recovery

0900 - All three Cores are homogenized and placed in 4 glass Jars using a Stainless steel spoon that has been precleaned. (occurred at all Sample Stations)

9/10/02

The Jars consist of
(1) one 32 oz - 8270/8081/8082/TPH
(1) one 16 oz. - Grainsize & TBT
(2) two 4 oz. - T. Metals/TOC/T. Cyanide

0900 - Collect SD-001.

0910 - relocate at sample location SD-002 which is about 20-30' downstream from SD-001. Sediment not placed in the Jars for SD-001 is left in a bowl for eventual combination with SD-002, SD-003 SD-004 + SD-005.

0912 - 1st Run - 26" of recovery

Description of Core

- upper 8" is more Sandy & micaceous with woody debris. the Sand is medium and rounded to subrounded
- Organic odor + Sheen visible
- Black to V. Dk grey

0919 - 2nd Run - 21" recovery

similar description, except not NAPL Blebs + Sheen associated with the NAPL - NAPL is Dk Brown to Black.

09:28 - 3rd run - 29" recovery.

9/10/02

HAHN & ASSOCIATES, INC.	SOIL BORING NUMBER SD-4			
434 NW Sixth Avenue				
Portland, Oregon				
(503) 796-0717	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT:	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
Northwest Natural Gas Co.	DRILLING METHOD:	Vibration/Push	Time:	Time:
Gasco Facility	EQUIPMENT TYPE	VibraCore attached to barge	9:33	9:50
Portland, Oregon	DRILLER:	Bill Jaworski	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems	1/23/96	1/23/96

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SAMPLE NUMBER*	TIME (1/25/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
SD-4-01	12:25	2.3	165/ND			
SD-4-02	12:30	4.0	-	1		SILT-brown, wet, very soft, roots, sheen, hydrocarbon odor (0"-6")
SD-4-03	12:36	9.5	-	2	ML	Sandy SILT-grey, wet, soft, roots, sheen, hydrocarbon odor (6"-3')
SD-4-04	12:47	13.6	-	3		Sandy SILT with gravel and wood chips-brown, wet, sheen, hydrocarbon odor (3'-4')
SD-4-05	12:54	24.3	-	4		
SD-4-06	13:00	23.4	-	5		Sandy SILT with fine grained sand seams-grey, moist, rootlets throughout, much vegetative material from 4' to 5', sheen within sand seams only, hydrocarbon odor (4'-6')
SD-4-07	13:30	16.7	-	6		
SD-4-08	13:32	15.6	-	7		Silty SAND-grey, moist, fine grained, root fragments, no sheen, hydrocarbon odor (6'-7')
SD-4-09	13:36	13.9	-	8	SM	Silty SAND-as above, many root fragments, no sheen, hydrocarbon odor (7'-9.5')
SD-4-10	13:38	12.3	-	9		
SD-4-11	13:40	11.6	0.15/ND	10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

Core: Core Interval; RECOVERY INTERVAL

2.7 FT COP

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/25/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

BORING NUMBER	SDDA-17 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	21-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, unconsolidated, blackish brown silty clay (25/75) with PAH odor.
				SS	12		**10-24" SILTY CLAY (ML)**
				SS			Soft, brown to black, methanogenic, silty clay (25/75) with minor sheening in <0.25" florets.
				MS	24		**24-43" SILTY CLAY (ML)**
				MS			Black,very slightly fin sandy, silty, clay (2-10/15-25/>65) with abundant sheen and strong coal
				MS	36		tar odor. Wood fragments interspersed throughout; widespread dense sheen.
				N			**43-90" SAND (SW)**
				N	48		Dark gray, damp, well-sorted, uniformly graded, fine sand (>95). Sands are subrounded.
				N			Three 3" brown rip-up clasts at 83". Very slight PAH odor in sands and distinct but moderate
				N	60		PAH odor in clasts. No Sheen.
				N			
				N	72		
				N			
				N	84		
				N			
					96		**90-96"- Not logged. Retained intact for geotech sample.**
				N			**96-120" SAND (SW)**
				N			Dark gray, exceptionally well sorted. Firm, moist, fine, 3-2 phi sand (>90) with slight PAH and
				N	108		rubber odors. No sheen. Rip-up clasts at 120" (10').
				N			
					120		**EOC**
					132		
					144		
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	20-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 ft
Acquisition: 10.7 ft
Recovery: 82%

Core not expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDB-22
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	23-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N			Loose, wet, unconsolidated, slightly silty clay (20/80).. No odor, no sheen.
				N	12		**10"-60" SILTY CLAY (ML)**
				N			Soft, wet, silty clay (20/80) with methane vesicles.
				N	24		
				N			33" 0.5" thick black band with increased sand (10) and slight PAH odor
				N	36		42" Black band with no PAH odor.
				N			47.5" Thin layer of light brown clay.
				N	48		
				N			
					60		60-66" Not logged. Retained intact for geotech sample.
							66-96" SILTY CLAY (ML)
				MS	72		Mottled and layered, dark gray silty clay (20/80). Darkest patchest of sediment
				N			have PAH odor. Band of diffuse sheen at 70.5".
				N	84		
				N			
					96		**EOC**
					108		
					120		
					132		
					144		
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 12:08
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 11 ft
Acquisition: 9.25 ft
Recovery: 84%

Core expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDDC-25 Core 2
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-24" SILTY CLAY (ML)**
				N			Loose, wet, dark brown unconsolidated, silty clay (30/70)woth PAH odor.
				N	12		Rip rap cobbles at 2" and 13" below mudline and coarse sand cobble lens at 24".
				N			**24-48" SILTY CLAY (ML)**
				N	24		Soft, consolidated, wer to moist, orgaqnic silty clay. Methane vesicles throughout.
				N			Olive brown and small organic particles throughout. 1/2" thick layer of
				N	36		of dark gray to black coarse sandy clay at 46" below mudline; layer has strong PAH odor.
				N			**48-58" SILTY CLAY (ML)**
				N	48		Wet, unconsolidated silty clay (30/70)
				N			**58-61**" Layer of 0.5 to 1.5" mechanically fragmented **WOOD** particles with interstital fines..
				Y	60		Strong H2S oder and slight PAH odor.
				Y			**61-78**" Brown to black, organic, **silty CLAY (ML)**.
				N	72		Laminar sand stringers at 54", 68" and 73". Stringers are <0.25 cm thick.
				N			Band of black, PAH enricjed sediments with mineralized PAH plane at 54".
				N	84		Wood fragments and wood layer 71-74".
				N			**78-87" Wood** fragments with interstitial fines. H2S and PAH odors.
				N	96		Wet, firm, mix of intact and mechanically fragmented wood particles.
					108		Getotech sample retained intact.
							EOC
					120		
					132		
					144		
					156		
					168		
					180		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 12 ft (Refusal)
Acquisition: 8 ft
Recovery: 67%

Core expanded based on compaction during processing
Material in core catcher discarded.

BORING NUMBER	SDUD-1 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							0-18"
							Loose, wet, fine sandy silt (30/70) 1" over moist, brown slightly silty (10) well-sorted, fine
					12		
SDUD 1-2				Yes			**SAND** (90). <0.25 dia. Sheen florets between 3-15". Silt present in laminae.
					24		
							18" of sample retained over 60" of continuous drive.
			30%		36		
					48		
					60		
							60-120"
					72		Top 2" fluffy sediment discarded. 62-75" soft, brownish gray, silty **CLAY** (40/60). Wet, slightly plastic with no odor and no sheen.
							75-96"
			60%		84		Firm, moist, brown, slightly sandy, clayey **SILT** (10/30/60). No odor, no sheen.
							Sand present as discrete laminar lenses.
					96		36" of recovery over 60" of continuous sample (-5 to -10 ft below mudline)
					108		
					120		
							120-180"
							120-122" Firm, moist to wet, brown, silty **CLAY** (30/70). No odor, no sheen.
					132		122-145" Gray, moist, very fine to fine **SAND** (>95) with a small silt subcomponent (<5).
							Sand nearly unimodal with faint gradiing with mode.
					144		
			60%				145-156" Interbedded, brow, moist to wet, plastic, silty **CLAY** (25/75) and lenses
							of well-sorted fine sand. Sand lenses range in thickness from 0.5 to 2.5".
					156		
							36" of recovery over 60" of continuous sample (-10 to -15 ft below mudline)
					168		
					180		

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-1 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							180-210" Soft, moist, slightly graded, well-sorted, very fine to fine **SAND**.
					192		No odor, no sheen.
					204		
			50%				
					216		
					228		
					240		
							EOD
					252		

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-1 Core 2
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				Yes			0-5" Loose, wet, soft, clayey **SILT** (30/70) with organic fragments, sheen,
				Yes	12		and coal tar odor.
							5-11" Very soft, blackish brown, organic, fine sandy, silty **CLAY** (15/30/55)
					24		Minor sheen (<0.25 florets) over interval and strong coal tar odor.
			45%				11-25" Interbedded brown, moderately sorted, slightly silty, very fine **SAND** (5/95).
					36		
							27" of recovery over 60" of continuous sample (0 to -5 ft below mudline)
					48		
					60		
							60-120" No sample retained.
					72		
					84		
			0%				
					96		
					108		
					120		
							120-150"
					132		Well sorted, slightly graded, very slightly silty (5-10) fine to medium **SAND**. No odor, no sheen.
							Rip-up clasts of brown clay at 131", 134", and 136".
					144		1.5" thick clay layer between 146" and 147.5" BM.
			50%				
					156		
					168		30" of recovery over 60" of continuous sample (0 to -5 ft below mudline)
					180		

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-1 Core 2
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							180"-210"
					192		Dark gray, moist to wet, very fine to fine, well-sorted **SAND** with stringers of silt/clay (50/50).
							Stringers are at 182", 1987.5" and 205". Rip-up clasts of brown clay at 207".
					204		
			50%				30" of recovery over 60" of continuous sample (0 to -5 ft below mudline)
					216		
					228		
					240		EOD

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-2 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							0-2"
					12		Soft, brown, wet, slightly sandy (15) clayey (15) **SILT** (70) with slight coal tar odor. No sheen.
							2-4"
					24		Soft, wet, gray silty (20) very fine **SAND** (80).
			66%				4-40"
					36		Dark grayish bown, soft, moist to wet, sandy (15) clayey (25) **SILT** (60).
							Lenses of sorted fine sand that are 0.5" thick at 12" and 17". 0.25" thick
					48		sand lens at 34" and a 1" thick sand lens at 36". No odor, no sheen
							40" of recovery over 60" of continuous sample (0 to -5 ft below mudline)
							60-65" Brown, firm, damp, silty **CLAY** (30-35/65). Slight coal tar odor, no sheen.
					60		65-78" Brown, soft to firm, damp to moist, plastic, slightly sandy, silty **CLAY** (10/30/60) with
							a <0.5" sand stringer at 73". Faint coal tar odor.
					72		78-79.5" Gray, well sorted, slightly silty (10), damp fine SAND (90). No odor.
							79.5-91" Brown, firm, moist, plastic, slightly sandy, silty **CLAY** (10/40/50) with sand stringers.
			60%		84		0.25" thick stringer at 84.5", 0.5" thick stringer at 86", and a 0.75" thick stringer at 89".
							79.5-91"
					96		Brown, firm, moist, plastic, slightly sandy, silty **CLAY** (10/40/50) with sand stringers.
							0.25" thick stringer at 84.5", 0.5" thick stringer at 86", and a 0.75" thick stringer at 89".
					108		91-96" Gray, wet, firm, sorted, silty (15) fine **SAND** (85). No odor, no sheen.
							36" of recovery over 60" of continuous sample (-5 to -10 ft below mudline)
					120		120-129" Brown, soft, plastic, moist, very fine sandy **SILT** (30/70) with micaceous flakes.
							109-151" Brown, plastic, moist to damp, fine sandy **SILT** (20/80) with sand stringers.
					132		Stringers at 140", 142", 126". Stringers <0.5" thick.
					144		
			52%				31" of recovery over 60" of continuous sample (-10 to -15 ft below mudline)
					156		
					168		
					180		

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-2 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							180"-217" Intercollated, brown, slightly sandy, silty, **CLAY** (5/45/50). Slightly firm,
					192		moist, plastic. No odor no sheen. Stringers of sell-sorted fine sand at 195" (3.5" thick), 203"
							(0.4" thick), 207.75" (0.25 " thick), and 211" (0.25" thick).
					204		
			62%				
					216		37" of recovery over 60" of continuous sample (-15 to -20 ft below mudline)
					228		
					240		EOD

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 12:08
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-2 Core 2
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							0-3"
					12		Loose, wet, slightly silty, sandy gravel with wood fibers and strong coal tar odor. (10/40/50)
							3-6"
					24		Firm, moist, brown, homogeneous, very slightly sandy, silty **CLAY** (<5/30/65-70)
			10%				Plastic. Distinct, moderate coal tar odor.
					36		Dark grayish bown, soft, moist to wet, sandy (15) clayey (25) silt (60).
					48		6" of recovery over 60" of continuous sample (0 to -5 ft below mudline)
					60		
							60-67" Soft, wet, silty fine **SAND** (25/75) with slight coal tar odor. Pore water runs fee.
							67-97" Soft to slightly firm, brown, trace fine sandy, clayey **SILT** (<5/40/55). Plastic.
					72		Lenses of fine sand at 71" (0.1" thick), 76" (0.5" thick), 81.3" (0.25" thick), 83" (0.25" thick)
							and 88' (0.25" thick).
					84		
			62%				
							37" of recovery over 60" of continuous sample (-5 to -10 ft below mudline)
					96		
					108		
					120		
							120-122.5" Gray brown, wet, well-sorted, soft, uniformly graded, slightly silty, fine **SAND** (5/95)
							slight coal tar odor. No sheen.
					132		122.5-137" Slightly reddish brown, slightly soft, plastic, sandy, silty **CLAY** (15/30-40/45-55).
							Slight coal tar odor. Well sorted uniformly graded sand stringers at 125" (0.25" thick), 128.5"
					144		
			57%				(0.5" thick), 132" (0.75" thick) and 134" (2.5" thick).
					156		
							137-154" Dark grayish brown, slightly fine sandy, clayey **SILT** (00/35-45/>50).Moist, plastic,
							several thin (<0.1") stringers of very fine sand.
					168		
							34" of recovery over 60" of continuous sample (-10 to-15 ft below mudline)
					180		

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-2 Core 2
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	18-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time	No. of Jars	% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							180"-183" Firm to hard, brown, plastic, slightly silty **CLAY** (20/80). No odor, no sheen.
							183"-200" Dark brownish gray, intercollated, wet, very fine sand and clayey **SILT** (5/20/75).
					192		Plastic. Well sorted, graded sand lenses at 188", 191", 193" and 199".
					204		
			62%				200"-211" Uniform, slightly soft, moist, very slightly sandy, silty, **CLAY**. No odor, no sheen.
					216		37" of recovery over 60" of continuous sample (-15 to -20 ft below mudline)
							211"-217" Dark gray, wet, soft, uniformly graded, well sorted fine **SAND**.
					228		37" of recovery over 60" of continuous sample (-15 to -20 ft below mudline)
					240		**EOD**

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	19-April-2008 12:08
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-27 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	4/18-19/2008
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							0-2" Loose, wet dark gray, very fine sandy **SILT** (20/80)
					12		2-26" Very soft, wet, slightly plastic, dark grayish brown, organic clayey **SILT**.
							Coal tar odor and sheening at 24"
				yes	24		26-27" Dark gray peaty lens with coal tar odor and sheening.
			80%				27-29" Slightly soft, brown, slity **CLAY** (30/70) with coal tar odor.
					36		29-34" Olive brown, homogeneous evenly graded silty very fine **SAND** (30/70). Moist.
							34-39.5" Interbedded brown silty **CLAY** (30/70) and unimodal, evenly graded medium **SAND**.
					48		39.5-48" Olive gray silty **CLAY** (30/70) moist at top and wet at bottom. Wood fragments.
							Thin wood layer at 41".
					60		48" of recovery over 60" of continuous sample (0 to -5 below mudline)
							60-63" heaved sand - discard
					72		63-66" Black, wet, slightly soft, evenly graded, slightly silty, medium **SAND** (10/90)
							Slight coal tar odor.
					84		66-80" Grayish brown, slightly soft, moist to wet, plastic, silty **CLAY** (30/70).
			50%				80-90" Moist, slightly firm, evenly graded, slightly silty FINE **SAND** (20/80).
					96		
					108		
							30" of recovery over 60" of continuous sample (-5 to -10 below mudline)
					120		
							120-125" Loose, wet, brown, silty clay that was discarded as heave/slough.
					132		125-152" Dark gray, uniformly graded, well-sorted, slightly silty FINE **SAND** (10/90). No odor.
					144		
			53%				
					156		
					168		32" of recovery over 60" of continuous sample (10 to 115 ft below mudline)
					180		

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

BORING NUMBER	SDUD-27 Core 1 (cont)
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	4/18-19/2008
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
							180-190" Dark gray, uniformly graded, well sorted, slightly silty very FINE **SAND** (5/95)
					192		190-191" Soft, brown, moist, silty CLAY (20/80).
							Stringers are at 182", 1987.5" and 205". Rip-up clasts of brown clay at 207".
					204		191-202" Dark gray, ,oist, slightly firm, uniformly graded, sorted, fine **SAND** with three laminar
			50%				bands of silt between 193" and 194". Band are <0.35" thick.
					216		
					228		22" of recovery over 60" of continuous sample (-15 to -20 ft below mudline)
					240		EOD

Coring Contractor	Cascade Drilling
Coring Method	Geoprobe
Core Type	Continuous sampler with piston and 2" liner
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 20 ft
Acquisition: Noted by 5 ft sampling intervals
Recovery: Noted by 5 ft sampling intervals

Core expanded based on compaction during processing
Material in core catcher discarded.
Log information set to top of sampling interval

Attachment E

Logs for Locations Exhibiting Substantial Product

Core Location G

BORING NUMBER	50BG
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
G-5--BG-0	0	5		N			**0-44 cm. 2.5Y 4/2. Slightly silty (15-20%) clay (80-85%).**
				N			Stiff, dry to slightly damp. 10-12 cm band of small (<0.5 cm) organic fragments
				N	20		(root/plant particles). Natural organic odor. No sheen produced with application of water.
				N			
				MS	40		**44-104 cm. Gley 1 2.5/N. Very clayey (40-50%) wood (50-60%).**
				MS			Black, soft, moist. Wood particles are mechanically fragmented and many have a blue coating
G-50-BG-26	66	71		MS	60		that becomes more pronounced with increased time exposed to air. Strong tar odor.
				MS			Minor sheen produced with application of water.
				MS	80		
				MS			
				MS	100		**104-427 cm. 2.5Y 2.5/1. Slightly silty (20%) clay (80%).**
				MS			Trace fine sand (<1%). Enitire unit is sompositionally similar in terms of sediment type.
				MS	120		Numerous depositional bands in unit.
				MS			136-136.5 cm. Band of wood/plant fragments with coal tar odor.
				HS	140		140-142.2 cm. Black stained sediment band in laminar orientation. NAPL.
				HS			
				HS	160		161-170 cm, Black, woody, strong coal tar odor.
				HS			
G-50-BG-72	182	188		HS	180		
				HS			191-192. Black stained sediment and mineralized NAPL plane. Very strong coal tar odor.
				HS	200		
				HS			213-227 cm. Black, organic, in-situ sheen and strong coal tar and naphthalene odors.
				HS	220		
				HS			233-240 cm. Very strong naphthalene odor. NAPL and blue sheen with application of water.
				HS	240		240-245 cm. Air pocket/void.
G-50-BG-98	249	254		HS			245-256 cm. Strong to overwhelming naphthalene odor. In-situ sheen with pressure.
				HS	260		256-261 cm. In-situ sheen, mineralized NAPL bands, very strong naphthalene odor. NAPL.
				HS			261-290 cm. 2.5Y 3/2. Moist. Very strong coal tar and naphthalene odor.
				HS	280		
G-50-BG-116	295	300		HS			290-299 cm. Black, dense in situ sheen. Very strong coal tar odor.
				HS	300		299-315 cm. 2.5Y 3/2. Moist. Very strong coal tar and naphthalene odor.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes:
Coring Method	Vibracore	Penetration:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Acquisition:
Core Collected	19-April-2008	Recovery:
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

Enclosure

BORING NUMBER	50 BG
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				HS			
				HS	320		315-317 cm. Black, strong in situ sheen and NAPL. Very strong coal tar and naphthalene odor.
				HS			317-350 cm. 2.5Y 3/2. Silty (20%) clay (80%) with strong coal tar odor.
				HS	340		slightly soft, plastic.
				HS			
				HS	360		350-352 cm. Black, in-situ sheen, NAPL, very strong coal tar odor.
				HS			352-367 cm. In-situ sheen and very strong coal tar odor.
G-50-BG-146	370	376		HS	380		367-374 cm. Black, in situ sheen. Strong coal tar odor.
				HS			380 cm. Plane of mineralized NAPL.
				MS	400		390-391 cm. Laminar black band with in-situ sheen and very strong coal tar odor.
				MS			391-427 cm. Slightly soft, plastic, damp to moist silty (15-20%) clay (80-85%). Moderate
				MS	420		coal tar odor.
							427 cm EOC
					440		

Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Notes:
Coring Method	Vibracore	Penetration:
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Acquisition:
Core Collected		Recovery:
COORDINATES		
SURFACE ELEVATION		Cores archived frozen since collection and thawed prior to Processing
DATUM		Core not expanded based on compaction during processing

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**1 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
GS-01-W(4-6)[1] GS-01-S(4-6)[2]	16.5 (0-23)	5	X	X				**0 to 23.0 feet: INTERBEDDED SILT (ML); SANDY SILT (ML); SILTY SAND (SM), AND SAND (SP)**; grayish-brown; loose sand; soft to firm silt; trace fine subrounded gravel; wet. Black staining 0 to 2.0 feet. Hydrocarbon-like odor. Odor decreasing with depth. Gravel decreasing with depth.
GS-01-W(9-11)[1] GS-01-S(9-11)[2] GS-01-S(10-12)[3]		10	X	X	X			
		15						
		20						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**2 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
GS-01-S(20-23)[2]								**0 to 23.0 feet: INTERBEDDED SILT (ML); SANDY SILT (ML); SILTY SAND (SM); AND SAND (SP)**, continued.
GS-01-S(20-23)[3]								
GS-01-W(23-27)[1]								**23.0 to 28.5 feet: INTERBEDDED SANDY SILT (ML) and SILT (ML)**; grayish-brown; soft to firm; wet. Sand lenses up to 1 inch.
		25						
								28.5 to 34.0 feet: SAND (SP); grayish brown; 95 to 100 percent fine to medium sand; trace to 5 percent fines; loose to medium density; wet. Silt lenses.
		30						
GS-01-S(30.5-33)[3]	24 (23-48)							
		35						**34.0 to 35.5 feet: INTERBEDDED SAND (SP)**; grayish-brown; 95 to 100 percent fine to medium sand; wet; **AND SAND WITH SILT (SP)**; grayish-brown; 85 to 95 percent fine to medium sand; 5 to 15 percent fines; loose; wet. Trace fine, subrounded gravel and cobbles.
								35.5 to 40.0 feet: INTERBEDDED SANDY SILT (ML) AND SILT (ML); grayish-brown; soft to firm; wet. Sand lenses up to 4 inches.
		40						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**3 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
GS-01-S(40-42.5)[3]								**40.0 to 48.0 feet: SAND (SP)**; grayish-brown; 95 to 100 percent fine to medium sand; trace to 5 percent fines; loose to medium density; wet. Silt lenses up to 1 inch.
GS-01-S(45-48)[2]		45						
GS-01-W(48-52)[1]								**48.0 to 77.0 feet: SAND (SP)**; grayish-brown; 100 percent fine to medium sand; trace fines and coarse sand; loose to medium density; wet. Increasing density with depth.
GS-01-S(50-52)[3]		50						
	24.5 (48-73)							
		55						
GS-01-S(59-61.5)[3]								
		60						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**4 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
		65						**48.0 to 77.0 feet: SAND (SP)**, continued.
GS-01-S(70.5-73)[3]		70						@ 69.5 to 71.5 feet: silt lenses up to 2-inches thick.
GS-01-W(73-77)[1]	11.5 (73-80)	75						**77.0 to 80.0 feet: INTERBEDDED BASALT; GRAVELLY SILT (ML)**; gray; 50 to 60 percent low to medium plasticity fines; 40 to 50 percent fine to coarse, angular to subrounded gravel; firm to stiff; damp to moist; **AND SILTY GRAVEL (GP)**; gray; 50 to 60 percent fine to coarse, angular to subrounded gravel; 40 to 50 percent
		80						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Gasco**	BORING NO.	**GS-01**
LOCATION	**Portland, Oregon**	PAGE	**5 of 5**
DRILLED BY	**Prosonic**	HOLE DIAMETER	**4-inch**
DRILL METHOD	**Sonic**	TOTAL DEPTH	**80.0'**
LOGGED BY	**Kelly Titkemeier**	DATE COMPLETED	**12/26/06**
		MUDLINE ELEVATION	**7.3 feet***

SAMPLE NUMBER	RECOVERY IN FEET (CORE INTERVAL)	DEPTH IN FEET	WATER SAMPLE	SOIL CHEMISTRY SAMPLE	GEOTECHNICAL SAMPLE	CORE INTERVAL	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
		85						low to medium plasticity fines; medium to density to dense; damp to moist.
		90						Bottom of boring = 80.0 feet.
		95						
		100						

REMARKS

*City of Portland Datum. [1]Water Sample. [2]Soil Chemistry Sample. [3]Geotechnical Sample.

ANCHOR ENVIRONMENTAL, L.L.C.

BORING NUMBER	SDDA-18 Core 1
PROJECT	U.S. Moorings
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	22-Apr-08
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Time		% Recov.	Sheen	Depth (inches)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				N			**0-10" SILTY CLAY (ML)**
				N	12		Wet, unconsolidated silty clay (30/70) with scattered very minor fine sand. Petroleum odor.
				SS			**10-10.75"**
				SS	24		Black band of poorly graded sandy silt (40/60) with strong petroleum odor and sheen.
				SS			Mineralized parting plane
				SS	36		**10.75-48" SILTY CLAY (ML)**
				SS			Soft, brownish olive-gray, methanogenic, mosit silty/clay (30/70) with thin (<1") sand stringers.
				SS	48		Bands of black sediment throughout unit and banded sediment has stong PAH oder. Bands
				SS			are 0.1-0.2 " thick and are at 24",26",30",31",38",41",43",44" below mudline.
				SS	60		**48-90" SILTY CLAY (ML)**
				SS			Soft, slightly cohesive silty clay that is moist and methanogenic. Varies from brown to black.
				SS	72		Interbedded stringers of silt and sorted very fine sand 58-59", 61.5", 71", 76" and 82".
				SS			Stringers are 0.25" thick at maximum. Bands of black sediment that has strong PAH odor and
				SS	84		sheen at 53-56", 63", 64", 75", 77",81"92" and 96". Mineralized PAH parting plane in 63" band.
				SS			
				SS	96		
				SS			**96-109" SILTY CLAY (ML)**
				SS	108		Soft, moist, cohesive, plastic, silty clay (30/70) with black band having mineralized PAH parting
				N			planes at 102" and 107".
				N	120		**109-138" SAND (SW)**
				N			Soft, damp, well-sorted, uniformly graded, gray fine sand with clasts of silty clay.
				N	132		No odor, no sheen.
				N			
					144		**138-144"- Not logged. Retained intact for geotech sample.**
				N			**144-167" SAND (SW)**
				N	156		Soft, damp, well-sorted, uniformly graded, gray fine sand with clasts of silty clay.
				N			No odor, no sheen.
				N	168		**167-174 Peat (Pt)**
				N			Peaty, oganic silt with laminar wood, root and plant fragments. Compact, wet.
				N	180		**174-197" SAND (SW)**
				N			Firm, well-sorted, uniformly graded fine sand with rip-up clasts of cohesive brown clay.

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	20-April-2008
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 19 ft
Acquisition: 16.8 ft
Recovery: 88%

Core not expanded based on compaction during processing
Material in core catcher discarded.

Within Dredge Area B

Core Location F

BORING NUMBER	20 BF
PROJECT	US Moorings PRP Study
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
F-SS20-BF-0	0	5		N			**0-10 cm. 7.5YR 3/2. Slightly soft, silty (30%) clay (70%).**
				N	20		Acrid decomposing organics odor.
				N			**10-69 cm. 2.5Y 3/2. Slightly soft, moist, organic (<5%), silty (20-30%) clay (70-80%).**
				N	40		Cohesive, plastic and slight acrid decomposing organics odor. No sheen visible with
				N			application of water. Homogeneous.
				N	60		
F-SS20-BF-24	58	63		N			**69-184 cm. 2.5Y 3/2. Soft, moist, organic (<5%), very clayey (40-50%) silt (50-60%)**
				N			with trace (<1%) very fine sand. Slight organic odor. No sheen could be produced with
				N	80		application of water.
				N			
				N	100		
				N			
				N			
				N	120		
				N			
				N			
				N	140		
				N			
				N	160		
F-SS20-BF-66	165	170		N			
				N			
				N	180		
				N			**184-228 cm. 2.5Y 3/2. Slightly firm, consolidated, moist, organic (<5%), very clayey**
				N			**(40-50%) silt (50-60%)** with trace (<1%) very fine sand.
				N	200		Slight coal tar odor. No sheen could be produced with application of water.
				N			**228-374 cm. 2.5Y 3/2. Slightly soft, plastic, moist to damp, organic (<1%)**
				MS	240		**silty (15-20%) clay (80-85%).**
				MS			Slight coal tar odor in upper portion of unit. Black, laminar bands at:
				MS	260		225-228 cm with moderate to strong coal tar odor
				MS			244-245 cm with strong coal tar odor
				MS	280		267-269 cm strong coal tar odor and blue ropy sheen produced with application of water.
F-SS20-BF-116	292	297		MS			288-295 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS	300		315-315.5 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			319-320 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS	320		

Estimated future dredge depth

Within 5 feet of future maintenance dredge surface, estimated at -24 feet CRD by USACE

Coring Contractor	Marine Sampling Systems/RV Nancy Ann
Coring Method	Vibracore
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum
Core Collected	
COORDINATES	
SURFACE ELEVATION	
DATUM	

Notes:
Penetration: 13 feet
Acquisition: 13 feet
Recovery: 100%

Cores archived frozen since collection and thawed prior to Processing
Core not expanded based on compaction during processing

Enclosure

BORING NUMBER	20 BF
PROJECT	US Moorings PRP Study
LOCATION	Willamette River, Portland, OR
PROJECT NUMBER	
DATE	25-Aug-09
LOGGED BY	D. Browning

SAMPLE INFORMATION						STRATA	DESCRIPTION
Sample ID	Interval Top (cm)	Interval Bottom (cm)	% Recov.	Sheen	Depth (cm)		USCS group name, color, grain size range, minor constituents, plasticity, odor, sheen, moisture content, texture, weathering, cementation, geologic interpretation, etc.
				MS			In black layers, sheen can also be produced in situ with application of pressure on sediment.
				MS			
F-SS20-BF-146	344	349		MS	340		333-341 cm interval is slightly sandy (<10%) and has slight vanillin odor in addition to strong
				MS			coal tar odor.
				MS	360		366-373 cm strong coal tar odor and blue ropy sheen produced with application of water.
				MS			
					374		**374 cm EOC**

		Notes:
Coring Contractor	Marine Sampling Systems/RV Nancy Ann	Penetration: 13 feet
Coring Method	Vibracore	Acquisition: 13 feet
Core Type	4" OD; 3.75"ID pre-cleaned 6061 Aluminum	Recovery: 100%
Core Collected		
COORDINATES		Cores archived frozen since collection and thawed prior to
SURFACE ELEVATION		Processing
DATUM		Core not expanded based on compaction during processing

SEDIMENT CORE LOG

Within Dredge Area B

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C528

Collection Date:	10/25/2005	**Logged By:**	Susan Fitzgerald
Core Processing Date:	10/26/2005	**Mudline Elevation (NAVD88 ft):**	-8.00
Core Tube Length (ft):	20.0	**Easting:**	7622856
Core Drive Length (ft):	19.0	**Northing:**	706193
Core Recovered Length (ft):	16.1	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

integral consulting inc.

LWG Lower Willamette Group

Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
0 to -390 / 0 to -12		SILT: silt w/tr v.fine sand, tr meth.ves.; soft; med grayish brown; mild sulfur odor; tr plant debris	0/<5/100	LW2-C528-A (ANALYZE)	146	28+
		SILT: silt w/tr v.fine sand as above, tr fine sand in lenses & laminae (1-3 mm thick) @155cm & in laminae & beds (up to 10 cm thick) below 398cm, tr meth.ves.; stiff-v.stiff; med grayish brown; tarry odor; blk stain in bands up to 14cm thick starting @ 154cm, sheen on some bands; tr rootlets; tr debris (4cm diam. pipe segment @ 345cm, metal debris @ 397cm), abrupt basal contact	0/<5/100	LW2-C528-B (ANALYZE)	310	24+
				LW2-C528-C (ANALYZE)	312	15
				LW2-C528-D (ANALYZE)	274	25+
				LW2-C528-E (archive)	31	28

black-stained bands reportedly start here but log does not specify exact locations or where interval ends

Estimated future dredge depth

SEDIMENT CORE LOG

PROJECT: Portland Harbor RI/FS **CORE ID:** LW2-C528

Collection Date:	10/25/2005	**Logged By:**	Susan Fitzgerald
Core Processing Date:	10/26/2005	**Mudline Elevation (NAVD88 ft):**	-8.00
Core Tube Length (ft):	20.0	**Easting:**	7622856
Core Drive Length (ft):	19.0	**Northing:**	706193
Core Recovered Length (ft):	16.1	**Coordinate System:**	NAD83/91 Oregon State Plane North, International Feet

Core Depth (cm/ft)	Lithology	Core Description	Grain Size % (G / S / Fines)	Sample ID	FID (ppm)	PID (ppm)
-390						
-400 -13						
-410						
-420						
-430 -14						
-440						
-450		SAND: fine sand, well sorted, w/tr silt lenses (1-3mm thick); dense; dk brownish gray; mild sulfur odor	0/100/<5	archive / ANALYZE LW2-C528-F	8	15
-460 -15						
-470						
-480						
-490 -16						